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WATER RESOURCES ACTIVITIES IN THE UNITED STATES. LAND AND WATER POTENTIALS AND FUTURE REQUIREMENTS FOR WATER

Select Committee on National Water Resources, U. S. Senate

December 1959

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WATER RESOURCES ACTIVITIES IN THE UNITED STATES

LAND AND WATER POTENTIALS AND FUTURE REQUIREMENTS FOR WATER

SELECT COMMITTEE ON NATIONAL WATER RESOURCES
UNITED STATES SENATE

PURSUANT TO

S. Res. 48

EIGHTY-SIXTH CONGRESS
FIRST SESSION

DECEMBER 1959

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(Pursuant to S. Res. 48, 86th Cong.)

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STATEMENT BY THE CHAIRMAN

DECEMBER 18, 1959.

To the Members of the Senate Select Committee on National Water Resources:

The use of water for agricultural purposes is the largest consumptive use of water in the United States, even though in recent years withdrawals of water for industrial purposes exceed those for irrigation. Generally, over half of the water withdrawn for irrigation is consumed by evaporation and transpiration, while less than a tenth of the water withdrawn for industrial purposes is consumed. Therefore, in view of the increasing trend to irrigation in the humid areas of the country as a means of increasing crop yields, irrigated agriculture may well be the most significant of the water uses which the Senate Select Committee on National Water Resources is directed to study by the provisions of Senate Resolution 48.

As a means of helping the committee to consider the extent and character of water resources activities that can be expected to be required to provide the quantity and quality of water needed for agriculture between the present time and 1980, a request was made of the Department of Agriculture to prepare a report which would provide us with estimates of what may be expected and what needs to be done in order that the tremendous increases in agricultural production that will be required for our growing economy can be achieved. In responding to the committee's request, the Department has considered the land and water potentials of the United States and made projections of future requirements for low, medium, and high levels of population in 1980 and 2000, with estimates of how these requirements may be divided among the several water resource regions into which the committee staff has divided the United States for the purpose of analyzing future water needs.

The report shows that storage and diversion of water for irrigation in 1954 was 195 million acre-feet, of which 115 million acre-feet were actually used for irrigation. Using the medium level population projections furnished by the committee staff, the Department estimates that water requirements for irrigation in 1980 will be only 181 million acre-feet for storage and diversion, with 114 million acre-feet actually used for irrigation; and by the year 2000, even though requirements for agricultural production are assumed to be twice the 1954 level, water requirements for storage and diversion may be only 199 million acre-feet, with irrigation use of 137 million acre-feet. If there were no improvements in the efficiency of storing, transporting, and using irrigation water, tremendous additional amounts of water would be required for irrigation, as much as 307 million acre-feet in the year 2000, but with the future adoption of known improved methods of water management for irrigation and continued research and education, the above reductions may be achieved.

This report will be of interest to you, the other Members of the Senate, and to others concerned with finding solutions to the Nation's water resource problems. Accordingly, I am having it printed as one of our committee prints on water resource activities which are being considered by the committee.

Because of the limited time available it was not possible for the Department of Agriculture to consider agricultural potential of Alaska and Hawaii as part of this study, but the committee is securing separate general reports covering the water resources of these two new States. A separate report is also being prepared covering water requirements of all the various programs of the Department of Agriculture, and their effect on water resources.

ROB'T. S. KERR,
Chairman, Select Committee
on National Water Resources.

COMMUNICATIONS

JULY 1, 1959.

Hon. EZRA TAFT BENSON,
Secretary of Agriculture, Department of Agriculture,
Washington, D.C.

MY DEAR MR. SECRETARY: Reference is made to my letter of June 15, 1959, concerning the work of the Senate Select Committee on National Water Resources.

One of the principal fields in which the committee will need information is agricultural use of water, which is the largest consumptive use. In view of the work which the Department of Agriculture is doing, we believe you may be able to provide us with the information we need. Accordingly, it is requested that a report be prepared for the committee to throw some light on what is to be expected and what should be done about agricultural use of water, increased use of which will provide one of several alternative methods of meeting indicated demands for agricultural products in future years.

Principal objective of the report is to inform the committee on the Nation's needs for water for increasing crop production and to provide us with background for developing the relationship of this use of water to other uses of water and to other means of increasing agricultural production.

We would like the report to contain the best estimates of the amounts of agricultural products for which the Nation's farms will find markets in 1970, 1980, and 2000 (or 2010), by major classification of product and broken down regionally by product. Estimates should be made of the amounts and kinds of agricultural products which may be produced by adding irrigated acreage, including supplemental irrigation of presently irrigated lands and cultivated but unirrigated lands, and by reclamation of land by other methods, such as drainage. Distinction should be drawn between lands lying east and west of the 100th meridian, and between project and nonproject type of irrigation. the report should also contain estimates of reasonably expected increases in yield from presently farmed acreage through factors such as improved plant and animal stock, improved practices of cultivation, including fertilization, improved pest control, and other methods.

This material should be broken down by regions and costs of production for each of the alternative means of increasing production should be given. Costs should include costs of displacing other land uses on land which is reclaimed.

We would like this subject to be covered in a summary report of not more than 10,000 words with whatever tables, charts, appendixes, and graphic illustrations as may be considered necessary. It would be most helpful if this information could be furnished the committee by October 1, 1959.

The committee staff will be glad to discuss any problems which may arise in the preparation of the report with representatives of the Department of Agriculture.

Sincerely yours,

ROB'T. S. KERR,
Chairman, Select Committee
on National Water Resources.

DEPARTMENT OF AGRICULTURE,
Washington, D.C., December 10, 1959.

Hon. ROBERT S. KERR,
Chairman, Select Committee on National Water Resources,
U.S. Senate.

DEAR SENATOR KERR: In response to your letter of July 1, 1959, the U.S. Department of Agriculture made estimates and analyses of the probable demands for farm products (not including forest products) under the different projections of population and economic growth made under certain assumptions for the years 1980 and 2000. We also made analyses of the capacity of our agriculture to meet these demands and of the increased use of water for irrigation that would result.

The projections indicate that situations involving scarcities of agricultural products would arise under possible high-population levels. Such situations would be in marked contrast to our current surpluses in some agricultural commodities. This report, therefore, is to be considered in the light of the assumptions used and not in the framework of existing circumstances. The assumptions, calculations, limitations, and policy implications are summarized in the first section of our report.

We endeavored to prepare the report in accordance with the detailed request in your letter. For some items, however, data were not available or time did not permit the obtaining of the additional data needed. We did not have time to work out estimates of the balance of requirements and production for different kinds of crops. Separate estimates were not made of needed supplemental irrigation of presently irrigated lands, but the estimates of future water requirements are for a full water supply for all irrigated land. We did not attempt to separate water requirements by project and nonproject type of irrigation. We considered, but did not evaluate completely, the impacts of the possible shift of one-fourth of our timber-growing capacity to cropland. This shift is not recommended; it is cited as one of the possbile ways of meeting food requirements.

In arriving at our estimates of land and water development, we used only rough estimates of costs for alternative means of increasing production, along with other data and information. As we had no adequate basis for the cost estimates, they are not included in the report. These problems were discussed with your staff director.

In preparing this report, many estimates had to be based on inadequate research or incomplete data. We believe that these estimates are accurate with respect to the direction of change and that they will be of assistance to the committee in its considerations, but we must emphasize that they are to be used only within the limitations indicated. Estimates cannot substitute for adequate research and data collection. In fact, this analysis has shown us the need for research in many fields not now adequately covered. In two separate reports we have covered research needs and other aspects of water use for agriculture.

We appreciate the opportunity to work with your committee, and we shall be glad to meet with the committee or with members of your staff to discuss the attached report.

Sincerely yours,

TRUE D. MORSE, *Acting Secretary.*

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LAND AND WATER POTENTIALS AND FUTURE REQUIREMENTS OF WATER

Summary and Implications

ASSUMPTIONS

This report includes an estimate of land and water use under three projected levels of population and economic growth. This general framework was used by direction of the staff director of the select committee. Total requirements for farm products in 1980 and 2000 are based upon projected population numbers, continued improvement in level of diet, and projected levels of exports and imports. Production requirements were divided into three components—crop production, pasture production, and product added by livestock. This report has been concerned with the crop and pasture production requirements. Analyses of other important products of the farm, such as forest products, fish, and wildlife, have not been included in this report.

Estimates are made of production increases that could be obtained from projected crop and pasture yields on both irrigated and nonirrigated land. Different assumptions as to price-cost levels or technological improvements would have produced higher or lower estimates. Expansion of urban and other special uses of land would result in production losses partly offsetting the projected yield increases.

Crop and pasture requirements are compared with production from the adjusted land base as measured in 1947–49 dollars. Different land and water development measures have been studied to indicate one means of meeting the indicated deficits between projections of requirements and production. It should be recognized, however, that this represents only one of several alternatives by which production could be raised above the projections used here.

CALCULATIONS

With these assumptions and framework projections, a series of calculations were made of requirements and potential production.

For the low level of population projections the increase in yields assumed from crops and pasture comes close to meeting requirements. Some land and water development might be needed to replace losses to nonfarm uses.

For the medium level population projections more land would be shifted to nonfarm uses and requirements would also be higher. Thus, the calculated deficit between projected production and projected requirements would be $7 billion in 1980 and $12.5 billion in 2000 and more land and water development or other means of increasing output would be needed.

When the high level population projections are considered the combined effects of increased requirements for farm products and the increased nonfarm uses of land become even more striking. For the high requirement in 1980, the calculated deficit in production is $11.5 billion and for the high requirement in 2000, it reaches $25.5 billion. Increased emphasis on land and water development and on other methods of increasing output would be needed to meet these estimates of the requirements in 1980. The increases estimated in this report from the various land and water development measures alone would fall about $6 billion short of meeting high requirements in 2000.

However, in all these estimates implying pressure of food requirements on supply, the price-cost relationship would be much different from those assumed, so that many measures besides land and water development would be called upon to meet deficits.

A summary of combined crop and pasture requirements, projected production, and land and water development to meet requirements, expressed in billions of 1947–49 dollars, follows:

	1954	1980			2000		
		Low	Medium	High	Low	Medium	High
Requirements	21.9	30.5	32.6	36.5	36.0	43.2	54.7
Adjusted production	21.9	26.1	25.6	25.0	31.9	30.7	29.2
Deficit	0	4.4	7.0	11.5	4.1	12.5	25.5
Land and water development:							
Grassland to cropland		2.1	3.1	4.3	2.3	4.3	5.7
Forest to cropland		.4	1.5	3.2	.4	3.8	5.8
Drainage of cropland		.5	.5	1.4	.6	1.8	3.2
Irrigation		1.3	1.3	1.3	.8	1.4	2.0
Pasture improvement		.1	.6	1.3	0	1.2	2.8

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For each of the levels of requirements, a projection has been made of the irrigation acreage needed and the requirement for a full water supply. Estimates have been made of requirements for storage and diversion and for requirements for irrigation after recovery of seepage losses.

These water requirements, in million acre-feet, are:

	1954	1980			2000		
		Low	Medium	High	Low	Medium	High
Storage and diversion	195	174	181	225	143	199	255
Irrigation	115	110	114	145	96	137	181

If there were no improvement in the efficiency of storing, transporting, and using irrigation water, about 307 million acre-feet would be needed for storage and diversion for the medium level requirements in 2000. It is estimated that the further adoption of known improved methods of water management for irrigation and continued research and educational programs will reduce this by an estimated 108 million acre-feet; possibly even more could be achieved.

LIMITATIONS

Statistical calculations of future requirements and production potentials cannot have a high degree of accuracy. Small errors in projections of trends or efficiencies can make large differences in the final estimates. The projections in the report are of value chiefly as indicators of the direction of change in important variables affecting our future requirements and supplies of farm and forest products.

Any conclusions drawn from the estimates in this report should be reached in light of the economic framework and other conditions that are assumed in the analysis. Account must be taken of the probability that other conditions might prevail. The yield projections for 1980 and 2000 are based on past rates of research accomplishment and rates of adoption of technology. Increased future emphasis on production research plus programs to accelerate adoption of improved practices would mean increasing production faster than projected in this report. Further, the change in farm price-cost relations implied in this report for the high requirements would probably result in a more rapid rate of development and adoption of yield-increasing technologies than were assumed in the original yield projections. Moreover, the estimates for water resource regions are based, not on statistical compilations, but on rough apportionments from State data or adjustment of various regional and U.S. data.

The projected potentials and requirements should not be construed as recommendations. They are estimates of what might happen under certain assumed conditions. Some of these conditions may or may not come to pass, such as substantive changes in water law, substantial conversion from forest to cropland, or substantial improvement in the efficiency of agricultural or water programs. The assumptions on which the land and water potentials and requirements are based point to important questions of policy.

In the short time available for this study, very little analysis could be made of costs of various types of land and water development, but our rough estimates indicate that much of the required development would not take place under present cost-price relationships. Further analysis should be made of the alternative ways by which requirements for farm products can be met in the most economical manner.

POLICY IMPLICATIONS

It is apparent that most of our increased production to meet future requirements must come from increased yields and increased efficiency in use of resources. Public efforts in conservation and development should recognize this fact.

The loss of productive crop, pasture, and forest land to urban and other special uses can be replaced only at high cost. With high population increases, policy regarding these shifts should be reexamined. Wherever a choice exists, public programs should encourage the use of unproductive land for these special uses.

The estimated irrigation development and improvements in efficiency of water storage, transportation, and application could not be achieved without changes in State water laws and their administration. The estimated irrigation acreage would involve use of water supplies which in some cases, are now used for other purposes. It would also be necessary to store and divert water to nonriparian lands. Probably the greatest problem will be redirecting State water laws and their administration to a concept of efficiency and beneficial use in order to achieve the savings in water made possible by research and technical service.

Significant withdrawals of commercial forest land for crop and pasture production will curtail our future timber supplies. The 73 million acres of forest land included in the potential cropland and pasture development to help meet high population level food needs include some of the Nation's most potentially productive farmland which also is the best forest potential, and if in trees, could be producing one-fourth of the Nation's sawtimber in 2000.

The transfer of forest land to crop production is an estimate of what might be done to meet increased food demands. Experience indicates it is in the long-range best interest of the Nation to maintain cropland and pasture acreages and production at stable levels in line with needs without wide fluctuations up and down. Likewise, unless the land devoted to timber production is fairly constant and there is very marked acceleration in forestry over recent trends toward improvement, the Nation's need for sawtimber products by 2000 will substantially exceed supplies. Thus, the question of whether and how much forest land will be converted to crop production to meet future food and fiber requirements for a large population will depend in part on relative prices of food and forest products and in part on public programs that affect land uses.

While we are currently faced with problems of overproduction and surplus disposal, we should not lose sight of the longrun requirements for land and water resources. This report indicates that we have great productive capacity, yet our land and water resources are relatively fixed. We cannot afford to waste them or to allow irreplaceable depletions. Where there is a choice we should preserve our more productive land.

It is clear that requirements for land and water for agriculture, urban development, industry, highways, and recreation will increase in the future. The rate of increase in requirements will be dependent on the level of population growth. The improvement and application of technology to keep pace with this increase, and the more intensive use of our land and water will require increased research and acceleration of programs for conservation, development, and management of these resources.

Introduction

In Senate Resolution 48, 86th Congress, 1st session, the U.S. Senate established a Select Committee on National Water Resources to study the extent to which water resources in the United States are related to the national interest, and the extent and character of water resource activities required for future population growth and economic development; and to obtain other information that would serve as a basis for considering water policies for the future.

In a letter of July 1, 1959, and in subsequent staff discussion, the select committee requested the Department of Agriculture to prepare a report on the probable demands for farm products (not including forest products), under different projections of population and economic growth, the capacity of agriculture to meet these demands, and the requirements for water for irrigation that would result.

In discussions with the committee staff it was agreed that all agencies would use the same economic framework. The committee staff chose a set of projections prepared by Resources for the Future, Inc. Each agency was directed to prepare its information by 22 water resource regions which approximate major river basins (fig. 1).

The regional information in this report is based on a few tabulations of county data and estimates from State data for the portions of States located in each region. Several of the projections are approximations based on broader regional and national data. This is a possible source of error but time did not permit any other procedure. It also should be pointed out that many of the estimates are based on inadequate research and survey data. We have made these estimates to aid the work of the committee but the estimates are subject to error and are no substitute for adequate research and data collection. In fact, this analysis has indicated how limited and inadequate our information is on water resources. Research needs in this field are outlined in a separate report. Other important limitations are the inadequacy of our research and information on potential technological improvement, and the need for a better basis and improved procedure for recognizing economic forces in regional projections.

In discussion with the committee staff it was agreed that the report would be confined to 48 States and would not cover Alaska and Hawaii. No data on these two States are included in the statistics.

Economic Framework

Prospective growth of population and the incomes generated by economic growth both in the

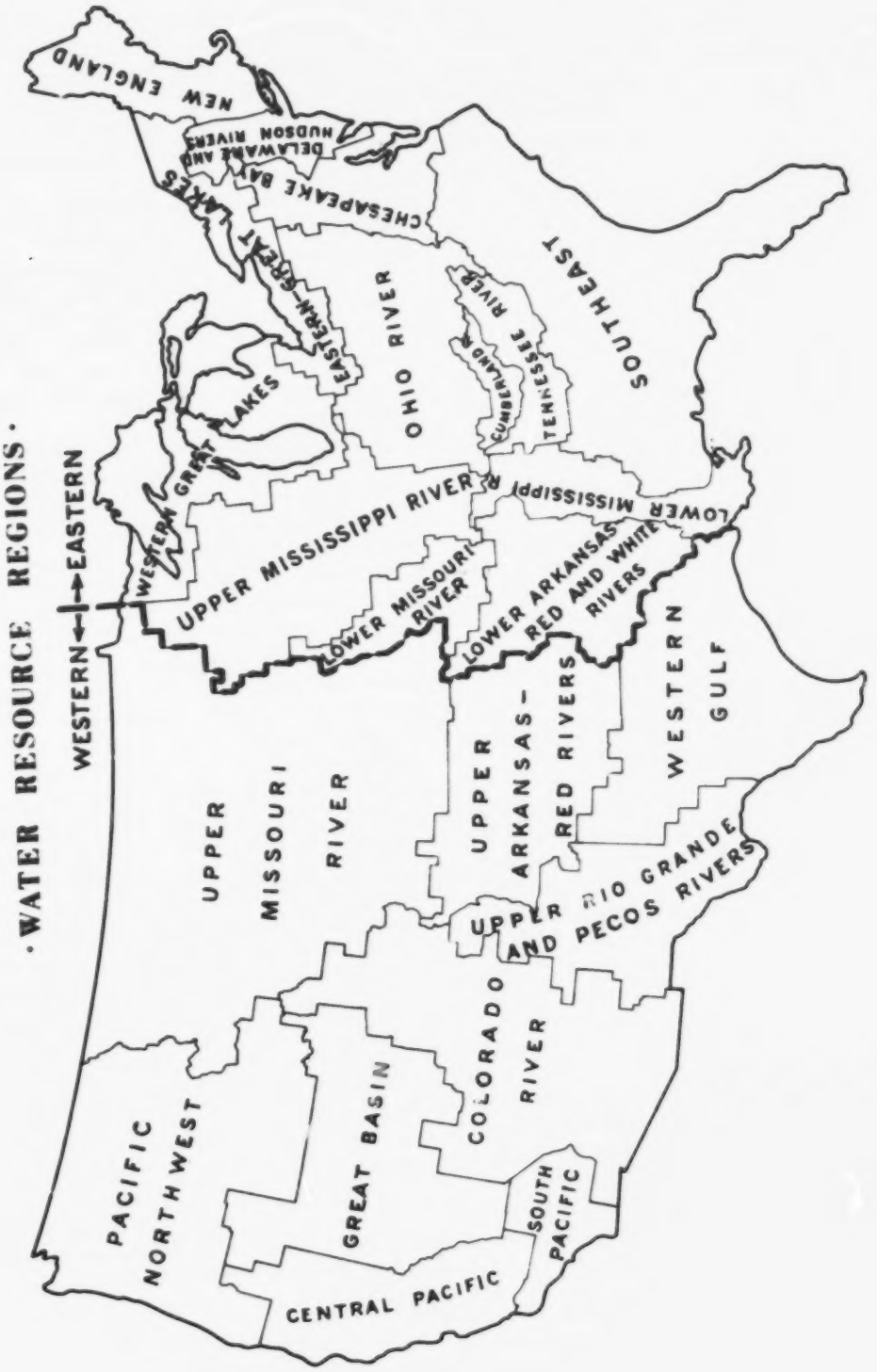
WATER RESOURCE REGIONS
WESTERN
EASTERN
NEW ENGLAND
DELAWARE AND HUDSON RIVERS
CHESAPEAKE BAY
GREAT LAKES
EASTERN GREAT LAKES
WESTERN GREAT LAKES
OHIO RIVER
CUMBERLAND RIVER
TENNESSEE
SOUTHEAST
UPPER MISSISSIPPI RIVER
LOWER MISSISSIPPI R.
LOWER MISSOURI RIVER
LOWER ARKANSAS-RED AND WHITE RIVERS
UPPER MISSOURI RIVER
UPPER ARKANSAS-RED RIVERS
WESTERN GULF
UPPER RIO GRANDE AND PECOS RIVERS
COLORADO RIVER
GREAT BASIN
PACIFIC NORTH WEST
SOUTH PACIFIC
CENTRAL PACIFIC

FIGURE 1

United States and abroad are the major factors to be considered in preparing any estimate of the domestic and foreign demand for this country's farm products over a span of 40 years in the future. At the direction of the select committee the analysis of future requirements for American farm production in this report was undertaken within a set of assumptions relating to population, labor force, employment, price level, and gross national product estimates prepared by the staff of Resources for the Future, Inc. A probable range of values, rather than a single value for any given year, was projected for each of these economic variables. High, medium, and low levels were estimated for periodic intervals of time up to 2000 (table 1).

The population projected for 1980 ranges from 25 to 50 percent above 1958; for 2000 the range is 45 to 140 percent above. The labor force and total employment are projected to rise even more rapidly. This is so because the birth and death rates assumed imply a larger proportion of the population within the working age group than at present. It is assumed that all of the gain in employment will be in the nonagricultural sector of the economy. The labor force and employment projections imply an unemployment rate of about 5 percent of the civilian labor force at the low end of the range in economic growth for both 1980 and 2000. In the past this has been considered a moderate unemployment rate. At the upper end of the range the unemployment rate is close to 3 percent for 1980 and 2 percent for 2000. Projected gains in productivity permit a rise in gross national product much greater than the gain in employment. Gross national product in 1980 is projected at 85 to 140 percent above 1960. By 2000 it would be 125 to 530 percent higher than in 1960. Prices are assumed at an estimated 1960 level, so that all of these increases represent a "real" gain in output of goods and services.

Requirements for Farm Products

Domestic requirements

The domestic demand for individual farm commodities was projected for 1980 and 2000 within the assumed economic framework, with high, medium, and low estimates for each of these 2 years. Basically, the method followed was to project requirements per person for all major crop and livestock products; these per capita estimates for each commodity were then multiplied by the projected population at each level to arrive at total requirements.

The per capita requirements for farm products were estimated by relating consumption to projected per capita income levels. Income elasticities of demand have been statistically estimated for all of the major farm commodities. The coefficients obtained in these studies were used to estimate per capita requirements in 1980 and 2000. It was assumed that beyond 1980, consumer incomes would have risen to such levels that most consumers would be eating the kind of diet they wanted and changes in per capita demand due to further changes in income beyond the high 1980 level would be negligible. Thus, projected increases in domestic requirements after 1980 reflect only the influence of population growth. By and large, recent price relationships among the individual commodities are assumed to continue. In addition to changes in income and population, other factors influence trends in consumption of farm products, but to a lesser degree. Nutritional and medical findings, food fads, and development of synthetic materials have all influenced past trends in consumption, although their influence is difficult to measure quantitatively. These and other intangible factors will continue to affect growth in the demand for farm products in the future.

Projected requirements within the economic framework outlined above indicate that the domestic market for farm products in 1980 will be within a range of about 60 to 90 percent above 1954 consumption levels, depending upon the population level assumed. By 2000, domestic utilization will be 85 to 200 percent higher than in 1954. The projected growth in domestic requirements for farm products (both food and nonfood) is approximately 12 percent greater than the advances in population projected for both 1980 and 2000 (table 2). The difference reflects increased consumption per person, including the continuing trend toward higher cost foods, as, for example, to the red meats and some of the fruits and vegetables. These changes improve the quality of the diet, yet add nothing to the number of calories or pounds of food consumed per capita. The projected increase in utilization also involves a small gain in per capita use of fats and a continued decline in per capita consumption of cereals and potatoes. These trends may be modified by developments in nutrition and medicine that affect food consumption patterns.

The increase in requirements for livestock products is considerably greater than for crops. The large gains among the livestock products are for meat animals and poultry. Required output of livestock rises considerably faster than feed requirements; this results from an increase in efficiency of feed conversion by livestock. Projected feed consumed per livestock production unit in 1980 is approximately 12 percent below the 1954 level; by 2000 it is 14 percent below 1954.

Imports of farm products are projected at 60 to 95 percent above the 1954 volume by 1980 and from 90 to more than 200 percent above by 2000. The major agricultural import items are coffee, cocoa, tea, bananas, and sugar (table 4).

FOREIGN COMMERCIAL DEMAND

The rough projections of foreign commercial demand for selected U.S. agricultural products in the years 1980 and 2000, shown in table 3, allow for (1) population growth in accordance with the 1958 revised U.N. projections, using the medium assumptions of 4.2 billion for 1980 and 6.3 billion for 2000; (2) absence of major wars resulting in widespread devastation of agricultural resources or large population losses; (3) some continued improvement in real per capita income; (4) continued expansion in allocation of resources to agricultural production, about in line with population growth except in the Far East, where one-half of the world's population lives and resources are most seriously limited; and (5) a continuation at about present levels of consumption except in areas of lowest per capita income countries where some improvement in the diet may be required to maintain stability.

Over the 40-year period the pressure for agricultural expansion may be such as to improve the comparative advantage of agricultural production in many countries. There is likely to occur also a substantial increase in world trade in agricultural products. The projections of foreign commercial demand for U.S. farm products take into consideration the likely trends of production in other surplus-producing areas and their ability to meet world needs, and the trends in industrial use of farm products, as well as the possibility of industrial substitutes insofar as they can be foreseen at this time.

Projections by commodities

Cotton.—World trade in cotton is expected to increase from some 14 million bales to about 18 million at the end of the 40-year period, with foreign demand for U.S. cotton accounting for about half the total. Major increases in demand will come from Canada, Europe, and the Far East.

Tobacco.—Serious foreign competition and the favored position of certain suppliers are likely to limit foreign demand for U.S. tobacco to 440 million pounds in 1980 and at most 500 million pounds by the year 2000.

Wheat.—With the exception of Europe, where imports are likely to decline, import requirements for wheat are likely to increase in all major areas of the world, and especially in the Far East where rice supplies are likely to show a decline relative to needs. The major wheat-exporting countries will be able to expand production more easily than the less-developed countries. Foreign demand for U.S. wheat is expected to increase substantially, especially in the latter half of the 40-year period.

Rice.—It has long been recognized that the dollar demand for U.S. rice is in the Western Hemisphere. Apart from some 20 percent of the demand that is projected as being from the Far East, the remainder is assumed to be from Latin America and Canada.

Feed grains.—World trade is expected to increase sharply over the next 20 years and then to rise slowly. Most of the demand for U.S. feed grains will come from Europe, where an increasing volume of imports will be required to sustain an expanding livestock industry. Most of the increase in Argentine feed grain production in the future is likely to be exported to other Latin American countries.

Fats and oils.—World demand is expected to increase sharply over the 40-year period, with nearly half the demand directed at U.S. availabilities. In the order of magnitude, the principal increases in demand will come from the Far East, Europe, and Latin America.

TOTAL UTILIZATION

Combined domestic and export requirements projected for 1980 would result in a level of utilization of U.S. farm products about 60 to 90 percent higher than in 1954. By 2000 an expansion in utilization ranging from 90 to 190 percent would take place. However, livestock and crop output requirements each are projected as rising more slowly than this (table 4). This is so because the summation of crops and livestock excludes from the total the feed other than the pasture group,

which increases relatively slowly. This procedure is necessary in order to avoid double counting of the value of feed other than pasture both as part of crop production and as part of livestock production.

The projected requirements of major crops are shown in table 5.

FARM OUTPUT REQUIREMENTS

Farm output is a measure of the volume of farm production for eventual human use. Three major subgroups of gross production were computed—crop production, pasture production, and product added by livestock (table 6). In this report the farm output requirements for crops and pasture have been used to determine the land and water requirements for the low, medium, and high population projections in 1980 and 2000. Both requirements and farm output have been expressed in comparable terms (1947–49 dollars) so that a balance of output and requirements can be made.

The requirements for crop and pasture output in 1947–49 dollars follow:

[In billions of dollars]

	1954	1980			2000		
		Low	Medium	High	Low	Medium	High
Crop	20 0	28 1	30 0	33 5	33 2	39 7	50 1
Pasture	1 9	2 4	2 6	3 0	2 8	3 5	4 6

TECHNOLOGICAL CHANGE

Gains in farm technology have been our chief source of increase in farm output in the United States, especially during the last three decades. From World War I to World War II, advances in farm mechanization accounted for half of the greater output. As tractors, motortrucks, and automobiles replaced horses and mules as sources of power on farms, substantial acreages of cropland and pastureland and large amounts of labor and other resources were released from growing of feed for maintenance of horses and mules. By the end of the fifties, the replacement of animal power by mechanical power was virtually complete.

With the notable exception of broiler production, we have made slow progress in increasing the efficiency with which livestock convert feed into milk, meat, and other livestock products. However, according to U.S. Department of Agriculture scientists, we do have available the technical knowledge for significant future gains in feeding efficiency. On this basis, substantial gains in feeding efficiency have been projected, as noted in an earlier section. As the bulk of our crop and pasture land is devoted to production of feed crops, this increasing efficiency in feed conversion is expected to be an important source of additional farm output during the next 40 years.

About half of our added output since 1940 has come from increased yields. The greater part of our future gains in farm production will have to come from this source. Our potential for further increasing the yields of crops is appraised in the following section.

CROP YIELDS

Projections of crop yields for 1980 and 2000 were based chiefly on results of research by U.S. Department of Agriculture scientists and farm economists to determine yield possibilities for 1975. In making the 1975 projection for each crop, agricultural scientists from such specific research areas as plant breeding, plant diseases, insects, weeds, soils, and water were consulted by agricultural economists. Major emphasis was placed on projecting yields that farmers could attain economically on the average under assumed conditions. The major assumptions were (1) there whould be greater use of technology presently known by research workers; (2) the future rate of adoption by farmers of improved practices would be consistent with current educational efforts and technical assistance; (3) price-cost relationships for farm products in 1975 would be consistent with a high-employment economy; (4) average weather would prevail in the projected period; and (5) no major wars or depressions would occur during the projected period. The initial projections of yields of some crops were subsequently reviewed and revised to the extent indicated by newly available information and current developments in crop yields.

The yields used in this study for 1980 and 2000 are listed in table 7. They were developed by assuming that the annual rate of increase in yields from 1951–53 to 1975 used in the study referred to above would continue from 1975 to 1980 and 2000. This assumes that new technology will be developed and adopted by farmers at about the same rate as the last few decades.

The crop yields projected for 1980 and 2000 average 42 and 75 percent, respectively, greater

than yields in 1954. Cropland pasture yield was projected to increase from 1,109 feed units per acre in 1954 to 2,470 feed units in 2000. Substantial increases in yields of open permanent pasture also were projected. Yield increases for woodland pasture and grazing land not in farms are estimated to be small.

It should be emphasized that the yield projections for 1980 and 2000 are based chiefly on past rates of research accomplishment and rates of adoption of technology by farmers. Consequently, the yield projections listed in table 7 are conservative estimates of what might occur under some of the high levels of requirements for farm products that are projected, especially those for the high-population assumption for 2000. Increased future emphasis on production research plus programs to accelerate adoption of improved practices by farmers offer possibilities of attainment of yield levels much higher than those used in the present report.

CROP OUTPUT FROM 1954 CROPLAND

The output from the projected crop yields and the crop acreage in 1954 is shown in table 8 for groups of specified crops. This is expressed in 1947–49 dollars so that output can be compared with requirements. The distribution of output from all crops with projected yields by water resource region is shown in table 9.

A summary of the output per acre from projected yields, expressed in 1947–49 dollars, follows:

	1954	1980	2000
Eastern	$66	$92	$115
Western	49	68	85
United States	58	81	101

PASTURE OUTPUT FROM 1954 PASTURELAND

The output from projected pasture yields and the 1954 pasture acreage, including rangeland, is shown by water resource regions in table 10. Output is expressed in feed units and approximated in 1947–49 dollars so that pasture output can be compared with pasture requirements. These estimates provided a basis for estimating changes in farmland output resulting from projected shifts between grass and crop uses. The pasture production estimates were developed for different types of pasture.

A summary of output per acre, in pounds of feed units, from all pasture types shows:

	1954	1980	2000
Eastern	398	645	813
Western	141	185	228
United States	201	293	364

Expressed in 1947–49 dollars, the output per acre would be:

	1954	1980	2000
Eastern	$3.70	$5.99	$7.55
Western	1.34	1.76	2.17
United States	1.83	2.67	3.32

PRODUCTION FROM IRRIGATED AND NONIRRIGATED LAND

In order to provide information on the probable future demand for irrigation water, it has been necessary to develop estimates of the potential contribution of irrigation to crop and pasture production now and in the future. Data on which to base such estimates are very inadequate.

A first step was to establish the level of yields likely to be attained for all crops and pasture in 1980 and 2000. (See preceding discussion on crop yields.) Assumed in these estimates of attainable yields was a continued increase in irrigation acreage. For ease of reference this increase in irrigation has been called potential I (table 11).

The recent trend in irrigated acreage and the assumed further increase included in potential I for 1980 and 2000 follow:

[In millions of acres]

	1939	1949	1954	1957	1980	2000
Eastern	0.4	1.0	2.0	2.4	3.3	5.7
Western	17.6	24.8	27.6	32.0	32.4	37.9
United States	18.0	25.8	29.6	34.4	35.7	43.6

Once overall yields were estimated, a second step was to establish the relative yields of irrigated and nonirrigated crops and pasture. This breakdown was completed for all major crops and for the four major types of pastureland and then combined on the basis of 1954 acreages into an average output per acre separated for crops and pasture.

CROPLAND

The crop production from projected yields on irrigated and nonirrigated cropland is shown in table 12. The 1954 harvested crop acreage is held constant, but the amount of irrigation is

increased as indicated in potential I for 1980 and 2000.

This results in production of irrigated crops as a percentage of total crop production, as follows:

	1954	1980	2000
Eastern	3.6	6.5	11.2
Western	44.5	45.6	49.3
United States	19.7	21.7	26.0

The output per acre is much higher on irrigated land than on nonirrigated land in the same region (table 13). In most of the eastern regions irrigation is used primarily for high-value crops and the average output on irrigated land is much higher than in most of the western regions.

Value in 1947–49 dollars of output per acre, from irrigated and nonirrigated cropland, follows:

	1954		1980		2000	
	Irrigated	Nonirrigated	Irrigated	Nonirrigated	Irrigated	Nonirrigated
Eastern	$336	$64	$461	$87	$546	$104
Western	145	32	189	44	210	54
United States	156	50	216	69	254	83

PASTURE

Pasture production from projected yields on irrigated and nonirrigated pasture land is shown in table 14. The 1954 pasture acreage is held constant, but the amount of irrigation is increased as indicated in potential I for 1980 and 2000.

The production of irrigated pasture as a percentage of total pasture production follows:

	1954	1980	2000
Eastern	0.4	0.7	1.2
Western	8.9	12.7	14.6
United States	5.6	7.0	7.6

The value of production per acre in 1947–49 dollars from irrigated pasture and nonirrigated pasture, as shown in table 15, is summarized as follows:

	1954		1980		2000	
	Irrigated	Nonirrigated	Irrigated	Nonirrigated	Irrigated	Nonirrigated
Eastern	$18.83	$3.69	$31.05	$5.98	$41.45	$7.46
Western	24.18	1.21	38.64	1.53	47.40	1.83
United States	23.96	1.79	38.19	2.56	46.89	3.15

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Potential Land and Water Development

LAND CAPABILITY

Possibilities for shifts in land use, if such shifts are needed in the interest of better conservation of land resources or for greater production of agricultural commodities, are indicated by an evaluation of the soils made by the U.S. Department of Agriculture in 1948–49.

The soils were grouped into eight land-capability classes (table 16). These classes in turn were subdivided into subclasses and units according to more detailed characteristics pertaining to kind of limitations on use and necessary management practices. These land classes indicate the degree of risk involved in using the land for different purposes.

Soils in class I are level and easy to farm, and there is little or no danger from erosion. Soils in capability classes II and III are also suited to cultivation if certain limitations such as slope, texture, or other permanent limiting features are kept in mind in using it. Soils in class II need such easily applied practices as contouring, protective cover crops, or simple water-management practices. Soils in class III can be cultivated safely only if careful attention is given to such conservation measures as terracing and strip-cropping on slopes and good water management on flat areas.

Capability class IV includes soils that have very severe limitations that restrict the choice of plants, require very careful management, or both. When used for cultivation very careful management is required and the conservation practices are difficult to apply or maintain.

Soils in classes V, VI, and VII are generally not suited to cultivation but may be used for grazing or forestry. Some class VI and VII soils may be used for special crops with very careful management or reclamation. Class V land has few restrictions when used for grazing or forestry; land in classes VI and VII has moderate to severe limitations when used for these purposes.

Soils in class VIII are arid, rough, steep, stony, sandy, wet, or severely eroded. Some examples of land in class VIII are rocky foothills, rough mountain land, bare rock outcrops, coastal sand dunes, marsh and swampland, and arid land not suited to grazing. Small areas may be fitted for special crops by sustained reclamation.

The acreage in the different land capability classes follows: [1]

[In millions of acres]

	Classes I, II, and III	Class IV	Classes V, VI, VII, and VIII
Eastern	356.2	73.9	229.0
Western	247.9	58.0	778.3
United States	604.1	131.9	1,007.3

Cropland suitable for regular cultivation

Estimates show that 389 million acres of the land that was in cropland in 1950 are in capability classes I, II, and III, and are suitable for regular cultivation with proper farming practices under good management. Of the 1950 cropland suitable for full-time cultivation, 53 million acres are class I, or very good soils that require no special erosion-control or other practices; 171 million acres are class II, or good soils that need only simple erosion-control practices and correction of fertility needs; and 165 million acres are class III soils, which are sloping and moderately fertile, and which are difficult to drain or irrigate, or for some other reason need special practices for permanent use as cropland. Another 49 million acres of land that was in crops in 1950 are class IV soils, which are severely limited as to possibilities for cultivation. Most of these soils are suitable for only occasional cultivation in long-time rotations. In addition, 40 million acres in capability classes V, VI, VII, and VIII, or about 9 percent of the cultivated cropland, are not suitable for use as cropland (table 17). These soils are too steep, too eroded, or too stony for cultivation, or are otherwise poorly adapted to cultivated crops. Thus, of the 478 million acres that were used as cropland in 1950, 81 percent are adapted to full-time cultivation, and 10 percent can be under limited cultivation with suitable precautions.

Land use shifts and adjustments

About 219 million acres of land in capability classes I, II, and III that are now in grassland pasture and woodland could be used for cropland if necessary but only with considerable impacts on production of pasture forage and forest products. At the same time, however, about 40 million acres in capability classes V, VI, and VII that are presently used as cropland should be shifted to grassland and woodland uses (table 17). Thus, the net potential shift in land use from grassland and woodland to cropland that appears to be physically feasible amounts to about 179 million acres. An additional 83 million acres of grassland and woodland in capability class IV may have some potential use as cropland, although they are severely limited for that use. It may be noted from the accompanying tables that from a capability standpoint only modest shifts in use are possible in some regions, whereas in other regions a considerable potential for increasing cropland exists.

Of the 219 million acres of grassland and woodland in capability classes I, II, and III, about 35 million acres would need drainage before they could be used as cropland. About 15 million acres of this land are in the Southeast region. Of the 35 million acres of land in capability classes II and III needing drainage, 10 million acres are in grassland and 25 million acres are in woodland at the present time (table 18).

The land shown by the capability estimates as most susceptible and physically feasible for development for longtime regular cultivation, through plowing and improvement of the soil, consists of 111 million acres of grassland pasture. Much of this grassland could be put into cultivation by plowing up the sod. About 10 to 15 million acres would require drainage and some would need irrigation, erosion-control practices, or other improvements. Of the 111 million acres of grassland suitable for full-time cultivation, about 11 million acres are in class I, 39 million acres are in class II, and 61 million acres are in class III (table 19). Plowing of pasture and use for cultivated crops would reduce the acreage available for pasture. It would substitute one kind of production for another, and some change in the systems of farming followed in different regions might be required.

For example, the largest areas of grassland pasture suitable for use as cropland are in the Western Gulf; Upper Missouri; Upper Arkansas, White, and Red; and Southeast water resource regions. If all suitable grassland in these regions were shifted to cultivated crops, drastic changes in use of land, types of farming and production would result. Shifts of grassland pasture to the cropland rotation, however, are feasible and desirable if spread over several years. Experimental tests and farm trials generally have shown that rotation pastures produce more forage than permanent pastures, and that at the same time they result in increased yields per acre of other crops in the rotation.

[1] 160.5 million acres of unclassified lands are not included.

About 95 million acres of the present grassland pasture in capability classes I, II, and III constitute the part of the 111 million acres most adaptable to shifting to the cropland rotation if needed to meet food and fiber requirements in 2000. In the eastern water resource regions 43 million acres that are presently used as grassland pasture are the best adaptable for shifting to cropland. In the western regions not over four-fifths, or about 52 million acres, could readily be shifted to the cropland rotation. Thus, only 95 million acres of the total 111 million acres are considered for shifting from pasture to cropland.

If cleared and properly cultivated, about 8 million acres of class I soils now in generally level and fertile woodland are capable of being shifted to cropland. Another 36 million acres of woodland in class II could be regularly cultivated if simple erosion-control practices are followed, and if the moderate fertility is increased by adding fertilizers or other soil amendments. An additional 64 million acres of class III woodland could be converted into cropland with permanent cultivation, but special erosion-control and soil-management practices would be needed. Here in the aggregate are approximately 108 million acres of high timber-growing potential forest land that could be converted to cropland, if the need for crops is greater than for timber (table 19). Included in the woodland potential is an estimated 25 million acres in classes II and III that would need drainage (table 18).

About three-fifths of the woodland that would need drainage if used as cropland is in the southeast and Chesapeake Bay water resource regions. The Ohio, Upper Mississippi, Lower Mississippi, and Lower Arkansas regions each have over a million acres of such land (table 18).

Farm woodland pasture and poorly stocked farm areas adjacent to existing fields would be the first to be converted to crop production. Nearly three-fourths of all grassland pasture and woodland best adapted to be cultivated is in farms, and most of the land not in farms which is suitable for farming is privately owned. Thus, only comparatively limited areas suitable for development are publicly owned.

The natural capability of the land for cultivated crops enters into the outlook for longtime development of cropland. The eastern water resource regions, with about 140 million acres of classes I, II, and III grassland and woodland suitable for use as cropland, appear to constitute an important area for future development. The western water resource regions have nearly 65 million acres of classes I, II, and III grassland that could be used for cropland.

Potential cropland suitable for irrigation

An estimate of the acreage of soils suitable for irrigation has been made by water resource regions in table 20. The availability of water was not considered in making the first estimate. A second calculation using a rough check on available water supply resulted in an estimate of the maximum irrigation potential. Water supply estimates did not take into account the improvement in water use efficiency discussed later.

The estimates follow:

[In millions of acres]

	Soils suitable for irrigation	Maximum irrigation potential
Eastern	31.2	31.2
Western	62.0	50.4
United States	93.2	81.6

INCREASED PRODUCTION FROM LAND AND WATER DEVELOPMENT

The previous section has examined the capability of the soils and possible land-use shifts and developments to meet future needs from a physical standpoint. This section is concerned with the increased production that might come from different types of land and water development and the relative costs of different developments. The major part of our national requirements can be met from existing crop and pasture land through increased yields.

In the irrigation projection we have provided increases to take care of high-value crops and to replace highly productive irrigated land lost to special uses. With this exception, production increases needed have been expressed as feed crops and feed equivalent units from pasture. To measure the relative efficiency of different types of development, an attempt was made to estimate the cost per unit of output.

Cropland development

Grassland to cropland.—The estimates of acreage that might be shifted from grassland to cropland (without drainage) is shown by regions in table 21.

The value in 1947–49 dollars of the net production increase in feed crops from this shift would be:

	Million acres	Million dollars	
		1980	2000
Eastern	33.1	2,037.1	2,655.4
Western	51.3	1,626.2	2,217.1
United States	84.4	3,663.3	4,872.5

Grassland to cropland requiring drainage.—The estimated grassland acreage that might be drained and shifted to cropland is shown in table 21.

The value in 1947–49 dollars of the net production increase in feed crops from this development is as follows:

	Million acres	Million dollars	
		1980	2000
Eastern	10.1	630.1	829.6
Western			
United States	10.1	630.1	829.6

Forest land to cropland.—The best adapted portion of the forest land that can be shifted to cropland without drainage is estimated in table 22.

The value in 1947–49 dollars of the production of feed crops from converting this land from forest to cropland would be:[2]

	Million acres	Million dollars	
		1980	2000
Eastern	37.2	2,883.0	3,536.8

Forest land requiring drainage to cropland.—The conversion of well-adapted forest land to cropland where drainage is required is estimated in table 22.

The value in 1947–49 dollars of the production of feed crops from this type of land development is estimated as follows:

	Million acres	Million dollars	
		1980	2000
Eastern	24.7	1,917.8	2,222.6

Drainage of existing cropland.—The acreage of existing cropland requiring drainage is estimated in table 23.

[2] Neither this nor the following table consider the value of the forest products not grown on the converted land nor the impacts on the general economy of the increase in price of timber products that might result from diverting timberlands from trees to tilled crops.

The value in 1947–49 dollars of the production increase in feed crops from this measure is estimated as follows:

	Million acres	Million dollars	
		1980	2000
Eastern	42.8	1,325.1	1,935.2

Irrigation development

The irrigated acreage has been estimated in three steps. In the national yield projections an expansion of irrigation was assumed as shown in table 11. This level of irrigation is called irrigation potential I.

A second step was to project a slightly higher level of irrigation expansion by projecting past trends and examining current irrigation development plans. This added irrigation development has been called irrigation potential II. A third step was to estimate the maximum irrigation development on the basis of suitability of soil and a rough check of water supply. The difference between maximum development and the sum of potentials I and II we have called irrigation potential III.

Irrigation potential II.—The acreage of irrigation potential II is given by water resource regions in table 24. Since it is estimated that this added irrigation would be used for high-value crops, the same production increases are attributed to potention II as to potential I.

The crop production increase from potential II, valued in 1947–49 dollars, is as follows:

	1980		2000	
	Million acres	Million dollars	Million acres	Million dollars
Eastern	1.3	606.5	1.2	620.3
Western	3.6	301.4	4.5	484.2
United States	4.9	907.9	5.7	1,104.5

The pasture production increase from irrigation potential II would be:

	1980		2000	
	Thousand acres	Thousand dollars	Thousand acres	Thousand dollars
Eastern	278	4,306	209	4,286
Western	747	19,650	907	31,555
United States	1,025	23,956	1,116	35,841

Irrigation potential III.—The acreage of, and production from, irrigation potential III are shown in table 25. The production is computed in terms of increased feed production and consequently is considerably lower per acre than production from irrigation potentials I and II which include a large proportion of high value crops.

The value in 1947–49 dollars of the feed crop production increase from irrigation potential III is as follows:

	1980		2000	
	Million acres	Million dollars	Million acres	Million dollars
Eastern	26.3	945.1	24.1	1,079.7
Western	13.7	1,010.9	7.2	682.9
United States	40.0	1,956.0	31.3	1,762.6

Pasture development

Cropland to grass.—The acreage of cropland that might be shifted to grass and the feed production equivalent is given in table 26. This includes the 40 million acres of cropland in land capability classes V, VI, VII, and VIII (table 17) and an additional 10 million acres in the western regions. Since this is low-producing cropland, it is estimated that the shift from crops to grass results in an increase in feed production.

The value in 1947–49 dollars of the feed production increase from this shift follows:

	Million acres	Million dollars	
		1980	2000
Eastern	19.7	363.9	305.1
Western	30.0	170.4	104.2
United States	49.7	534.3	409.3

Forest land to grass.—The acreage of forest land that might be shifted to grass is shown in table 27.

The feed production from this development, valued in 1947–49 dollars, would be:[3]

	Million acres	Million dollars	
		1980	2000
Eastern	11.4	576.6	643.7

Range and pasture improvement.—Pasture improvement possibilities, in addition to improvements considered, with projected yields, are estimated in table 28.

[3] This table does not consider the value of the forest products not grown on the converted land or the impacts on the general economy of the increase in price of timber products that might result from diverting timberlands from trees to grass.

Pasture improvement would result in the following production increases, valued in 1947–49 dollars:

	Million acres	Million dollars	
		1980	2000
Eastern	14.6	431.7	509.4
Western	56.2	839.3	1,171.6
United States	70.8	1,271.0	1,681.0

Land Use

CROPLAND AND PASTURE RESOURCES

A fourth of the land in continental United States is cropland and a third is permanent pasture and grazing land (table 29). The rest is covered with forest, or is in miscellaneous other uses.

The distribution of land use in 1954 was as follows:

[In millions of acres]

	Cropland	Pasture	Forest	Other	Total
Eastern	240.7	64.6	354.6	84.7	744.6
Western	219.0	546.9	283.9	109.5	1,159.2
United States	459.7	611.5	638.5	194.2	1,903.8

NONFARM AND RELATED SPECIAL USES OF LAND

A source of major concern about land uses in the future is the increase in nonagricultural uses of land. In 1954, about 110 million acres were in intensive special uses; 19 million were in urban areas; 25 million were in transportation uses—roads, railroads and airports; 23 million were in national defense and atomic energy areas; 27 million were in parks and wildlife areas; 4 million were in flood control areas; 11 million were in farmsteads, farm roads and lanes and related sites; and the remaining million were in State institutional and miscellaneous uses. The remaining 84 million acres included deserts, sand dunes, bare rock areas, and marshes not used as military areas, parks, or wildlife areas.

LOSSES OF LAND TO NONFARM USES

Areas occupied by cities, towns, parks, airports, reservoirs, and highways, and in other special uses have increased greatly in the 40 years since 1920. Recently, the average rate of absorption of land into these special intensive uses has been about 1.5 million acres per year, of which about 20 to 25 percent is estimated to have been from cropland and about 15 to 16 percent from pasture.

Under medium assumptions as to population growth the acreage of special use areas is estimated to increase from 110 million acres in 1954 to 191 million acres in 2000 (table 31). Urban areas are projected to increase from about 19 million acres in 1954 to about 46 to 47 million acres in 2000; rural transportation facilities to increase from 24 million to 33 million acres; parks and wildlife refuges from 28 million to about 47 million acres; reservoir and flood control areas from 4 million to 15 million acres; national defense and atomic energy areas from 23 million to 29 million acres; and areas in all other special nonfarm uses from about 1 million to more than 8 million acres. Of this 81-million-acre shift to special uses for the medium population level, about 75 to 80 percent might come from woodland, pasture, and other land, and 20 to 25 percent from cropland.

The additional special land use requirements projected for low, medium, and high projected population levels from cropland and pasture are:

[In millions of acres]

	1980		2000	
	Cropland	Pasture	Cropland	Pasture
Low	7.2	4.6	12.2	8.2
Medium	10.0	6.2	20.2	12.7
High	14.3	8.4	33.4	20.2

Review of the trends in growth of special-use areas and in population growth by regions (table 30) indicates that estimates of the land required in these areas in the next 40 years would vary greatly depending upon the assumptions used as to public policies, projected population numbers, employment, and income. With the accelerating rates of growth in the Northeastern, Lake States, and Pacific States, it is possible that these regions will lead all others in acreages of land required for urban, transportation, and related purposes.

Along with growth in urban centers will come demands for increases in recreational areas, such as public parks and private vacation facilities. Because of the head start in national forest, park, and wildlife areas set aside from the Western public domain, the Mountain and Pacific regions may continue to rank high in terms of area and scenic values. Purchase of private land for necessary flood control and water supply purposes may add to recreational and wildlife areas. Private stream, lake, and seashore frontages will become more valuable.

Ordinarily, urban and transportation areas compete most directly with agriculture for the use of level and fertile land. Such related uses as open-country industrial sites, nonfarm residential and commercial sites in rural areas, strip mines, quarries, cemeteries, and golf courses, which are included in other land use categories, also compete frequently for good farmland. Recreational uses often compete successfully for the less desirable farming areas, provided the areas have relatively unspoiled natural features conducive to rest and fun.

The total acreages of land in special use for low, medium, and high population levels are as follows:

[In millions of acres]

	1954	1980			2000		
		Low	Medium	High	Low	Medium	High
Eastern	51.6	69.7	77.5	93.1	81.8	103.4	139.2
Western	58.6	69.5	72.3	76.5	76.3	87.9	102.7
United States	110.2	139.2	149.8	169.6	158.1	191.3	241.9

RETIREMENT AND CONVERSION OF ERODIBLE CROPLAND

Good farm practice has shown the wisdom of converting steep and erodible cropland to grassland and forest uses. Mechanization makes it increasingly economical to continue conversion of ill-adapted cultivated land to pasture and tree crops. Soil surveys indicate the desirability of shifting approximately 50 million acres of sloping land, highly erodible land, and otherwise poor cropland, to grass, trees, and other extensive uses (tables 16 and 26). About 20 million acres of this land are located in the eastern regions and 30 million acres in the western regions. Retirement of this acreage, in addition to losses to urban and other nonfarm uses, would still further reduce the present cropland acreage.

PROJECTED LAND USE WITHOUT LAND AND WATER DEVELOPMENT

Projected cropland acreages after deductions for (1) additional urban and other nonfarm uses and (2) conversion of steep and erodible cropland

to grass or trees are shown in table 32 and are summarized as follows:

[In millions of acres]

	1954	1980			2000		
		Low	Medium	High	Low	Medium	High
Eastern	240.7	215.4	213.1	209.5	211.8	205.1	194.4
Western	219.0	187.4	186.9	186.2	186.1	184.6	182.2
United States	459.7	402.8	400.0	395.7	397.9	389.7	376.6

Projections of pasture acreages after deductions for additional urban and other nonfarm uses and for grassland that will be required for crop production (table 33) range as follows:

[In millions of acres]

	1954	1980			2000		
		Low	Medium	High	Low	Medium	High
Eastern	64.6	20.1	19.6	18.7	19.2	17.7	15.1
Western	546.9	492.2	491.2	489.9	488.5	486.6	481.7
United States	611.5	512.3	510.8	508.6	507.7	504.3	496.8

These estimates of land uses without new land and water development permit the calculation of the extent to which increased yields alone will meet the requirements for various population levels.

Land Requirements

PROJECTED PRODUCTION WITHOUT LAND AND WATER DEVELOPMENT

Production from cropland and pastureland projected in tables 32 and 33 with the yields shown earlier has been computed in tables 34 and 35.

These calculations indicate the following balance of production and requirements, in terms of value in 1947–49 dollars:

[In billions of dollars]

	1980			2000		
	Low	Medium	High	Low	Medium	High
Crop requirement	28.1	30.0	33.5	33.2	39.7	50.1
Crop production	23.8	23.6	23.3	29.1	28.4	27.2
Deficit	4.3	6.4	10.2	4.1	11.3	22.9
Pasture requirement	2.4	2.6	3.0	2.8	3.5	4.6
Pasture production	2.3	2.0	1.7	2.8	2.3	2.0
Deficit	1	.6	1.3	0	1.2	2.6

In the following section, estimates are based on the assumption that the various land and water development potentials will be drawn on for the needed production increases to meet the indicated requirements.

REQUIREMENTS FOR LOW LEVEL OF POPULATION IN 1980

Crop production

A deficit of $4.3 billion would occur in crop production compared with requirements as measured in 1947–49 dollars.

This deficit could be supplied by the following land and water development measures:

	Acreage	Increased production
	Million acres	*Billion dollars*
Grassland to cropland	33.8	1.5
Grassland to cropland (drainage)	10.1	.6
Irrigation potential II	2.5	.5
Forest to cropland (drainage)[1]	5.0	.4
Drainage of cropland	42.8	1.3
Total	94.2	4.3

[1] The possible conversion of forest to cropland as shown in this and, especially the larger acreages, in subsequent tables could not be made without serious impacts on national timber supplies.

Pasture production

A deficit of $100 million would occur in pasture production as measured in 1947–49 dollars. This could be supplied by 6 million acres of range and pasture improvement.

Major land uses

The major land uses in 1980 reflecting the development of cropland and pasture indicated to meet low requirements (table 36) are as follows:

[In millions of acres]

	Cropland	Pasture	Forest	Other
Eastern	234	56	340	115
Western	210	544	280	135
United States	444	600	620	250

REQUIREMENTS FOR LOW LEVEL OF POPULATION IN 2000

Crop production

A deficit of $4.1 billion, as measured in 1947–49 dollars, would occur in crop production from projected yields without land development. This deficit is about equal to the production from land lost to special uses.

The deficit could be supplied from the following measures:

	Acreage	Increased production
	Million acres	*Billion dollars*
Grassland to cropland	25.3	1.5
Grassland to cropland (drainage)	10.1	.8
Forest to cropland (drainage)	5.0	.4
Drainage of cropland	20.0	.8
Irrigation potential II	2.5	.6
Total	62.9	4.1

Pasture production

Pasture production would balance low level requirements under the projected yields for 2000.

Major land uses

The major land uses in 2000 reflecting the development of cropland and pasture to meet low requirements (table 36) are as follows:

[In million of acres]

	Cropland	Pasture	Forest	Other
Eastern	223	55	335	132
Western	207	532	277	143
United States	430	587	612	275

REQUIREMENTS FOR MEDIUM LEVEL OF POPULATION IN 1980

Crop production

A deficit of $6.4 billion would occur in crop production from projected yields without land development, as measured in 1947–49 dollars.

This could be supplied by the following measures:

	Acreage	Increased production
	Million acres	*Billion dollars*
Grassland to cropland	59.1	2.5
Grassland to cropland (drainage)	10.1	.6
Forest to cropland	10.0	.8
Forest to cropland (drainage)	10.0	.7
Drainage of cropland	42.8	1.3
Irrigation potential II	2.5	.5
Total	134.5	6.4

Pasture production

A deficit of $600 million would occur in pasture production from projected yields, as measured in 1947–49 dollars. This could be supplied by improvement of 30 million acres of range and pasture.

Major land uses

The major land uses in 1980 reflecting land development to meet medium requirements (table 37) are as follows:

[In millions of acres]

	Cropland	Pasture	Forest	Other
Eastern	260	56	322	107
Western	220	533	279	127
United States	480	589	601	234

REQUIREMENTS FOR MEDIUM LEVEL OF POPULATION IN 2000

Crop production

A deficit of $11.3 billion of crop production would occur from projected yields without land development, as measured in 1947–49 dollars.

This could be supplied by the following measures:

	Acreage	Increased production
	Million acres	*Billion dollars*
Grassland to cropland	67.5	3.7
Grassland to cropland (drainage)	10.1	.8
Forest to cropland	16.6	1.7
Forest to cropland (drainage)	19.8	1.9
Drainage of cropland	30.0	1.4
Irrigation potential II	5.7	1.1
Irrigation potential III	3.6	.7
Total	153.3	11.3

Pasture production

A deficit of $1.2 billion would occur in pasture production.

This could be supplied by 50 million acres of range and pasture improvement.

Major land uses

The major land uses in 2000, including land development to meet medium requirements (table 37), are as follows:

[In millions of acres]

	Cropland	Pasture	Forest	Other
Eastern	291	52	280	112
Western	232	529	274	124
United States	523	581	564	236

REQUIREMENTS FOR HIGH LEVEL OF POPULATION IN 1980

Crop production

A deficit of $10.2 billion in crop production, as measured in 1947–49 dollars, would occur with projected yields without land development.

This could be supplied by the following measures:

	Acreage	Increased production
	Million acres	*Billion dollars*
Grassland to cropland	84.4	3.7
Grassland to cropland (drainage)	10.1	.6
Forest to cropland	16.0	1.3
Forest to cropland (drainage)	24.7	1.9
Drainage of cropland	42.8	1.3
Irrigation potential II	5.0	.9
Irrigation potential III	2.8	.5
Total	185.8	10.2

Pasture production

A deficit of $1.3 billion would occur in pasture production, as measured in 1947–49 dollars.

This could be supplied by the following measures:

	Acreage	Increased production
	Million acres	*Million dollars*
Range and pasture improvement	70.8	1,276
Irrigation potential II	1.0	24
Total	71.8	1,300

Major land uses

The major land uses in 1980 reflecting land development to meet high requirements (table 38) are as follows:

[In millions of acres]

	Cropland	Pasture	Forest	Other
Eastern	304	52	292	97
Western	236	532	278	113
United States	540	584	570	210

REQUIREMENTS FOR HIGH LEVEL OF POPULATION IN 2000

Crop production

A deficit of $22.9 billion would occur in crop production with projected yields without land development, as measured in 1947–49 dollars.

This could be partially met by using all the potential land and water development as follows:

	Acreage	Increased production
	Million acres	*Billion dollars*
Grassland to cropland	84.4	4.9
Grassland to cropland (drainage)	10.1	.8
Forest to cropland	37.2	4.5
Forest to cropland (drainage)	24.7	2.3
Drainage of cropland	42.8	2.0
Irrigation potential II	5.7	1.1
Irrigation potential III	28.2	2.1
Total	233.1	16.7

These measures would fall short of meeting production requirements by $6.2 billion. Adoption of new technology beyond that projected, increase in fertilizer and other inputs, and more intensive cultivation might meet this deficit. These adjustments will be discussed in the last section.

Pasture production

A deficit of $2.6 billion would occur in pasture production in terms of 1947–49 dollars.

This could be more than met by the following measures:

	Acreage	Increased production
	Million acres	*Million dollars*
Cropland to grassland	49.7	409
Forest land to grassland	11.4	644
Range and pasture improvement	70.8	1,681
Irrigation potential II	1.1	36
Total	133.0	2,770

Major land uses

The major land uses in 2000 reflecting complete development of land and water resources to meet the high level requirement (table 38) are as follows:

[In millions of acres]

	Cropland	Pasture	Forest	Other
Eastern	302	50	238	150
Western	231	524	269	145
United States	533	574	507	290

IRRIGATION WATER REQUIREMENTS

Irrigation water requirements have been arrived at by estimating an annual irrigation water requirement per acre for 1957, 1980, and 2000, and by estimating the acreage that would be irrigated under low, medium, and high population projections in 1980 and 2000. The product of these two estimates gives the irrigation water requirement in acre-feet.

ANNUAL WATER REQUIREMENTS PER ACRE

Estimates of irrigation water requirements per acre irrigated in 1954 are given in table 39. This was derived by first estimating the net irrigation water requirement per acre, which is the amount of irrigation water required in the root zone of a plant to provide adequate moisture for growth. The efficiency with which water is applied on the farm was then estimated, providing a basis for

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estimating total water requirements on the farm. The next step was to estimate storage and delivery efficiency which, when applied to on-farm requirements, provided the basis for an estimate of storage and diversion requirements. This is the amount of water required to supply the net irrigation requirement per acre irrigated, taking into account all losses from evaporation and seepage.

Some losses from seepage are recovered through return flow and become available for reuse. An estimate of the percentage of these losses that might be recovered for irrigation use provides the basis for estimating the irrigation water requirement.

Increased research, technical assistance, and education in future years should result in the adoption of improved techniques for the conservation and use of water. The efficiency of water application on the farm and the efficiency of storage and delivery should improve materially as a result of these advancements. These improved efficiencies are reflected in the lower water requirements per irrigated acre in 1980 and 2000 shown in tables 40 and 41.

Estimates for the western areas reflect the present acreage of short-season crops that do not require a full water supply for the entire growing season, while estimates for the eastern areas are based on the frequency of occurrence of drought days and in general reflect a full water supply throughout the growing season for approximately 9 out of 10 years.

The anticipated storage and delivery efficiencies of the irrigation distribution systems which supply water to the farm reflect all losses by both seepage and evaporation.

TOTAL WATER REQUIREMENTS

The irrigated crop and pasture acreage that would be required to meet production requirements are given in table 42 for the low, medium, and high population projections in 1980 and 2000. Total water requirements have been estimated by multiplying the irrigated acreage needed by the water requirements per acre given in tables 39, 40, and 41. The storage and diversion estimate includes all the anticipated losses by seepage and evaporation, both on and off the farm, while the irrigation water requirements estimate reflects the recovery and reuse of a portion of these seepage losses.

The irrigated acreage and the estimated requirement for a full water supply for 1954 are given in table 43.

These data are summarized as follows:

	Irrigated acreage	Storage and diversion	Irrigation water requirement
	Thousand acres	*Thousand acre-feet*	*Thousand acre-feet*
Eastern	2,002	5,388	4,736
Western	27,550	189,176	109,961
United States	29,552	194,564	114,697

Water requirements for low levels of population in 1980 and 2000

The irrigated acreage and water requirements for low population level projections in 1980 and 2000 are shown in table 44.

The requirements in 1980 are as follows:

	Irrigated acreage	Storage and diversion	Irrigation water requirement
	Thousand acres	*Thousand acre-feet*	*Thousand acre-feet*
Eastern	3,246	7,294	6,518
Western	31,797	167,130	103,217
United States	35,043	174,424	109,735

The low population level requirements in 2000 are:

	Irrigated acreage	Storage and diversion	Irrigation water requirement
	Thousand acres	*Thousand acre-feet*	*Thousand acre-feet*
Eastern	3,281	6,547	5,969
Western	31,543	137,159	90,092
United States	34,824	143,706	96,061

Water requirements for medium levels of population in 1980 and 2000

The irrigated acreage and water requirements for medium population level projections in 1980 and 2000 are shown in table 45.

The requirements in 1980 are:

	Irrigated acreage	Storage and diversion	Irrigation water requirement
	Thousand acres	*Thousand acre-feet*	*Thousand acre-feet*
Eastern	3,707	8,337	7,429
Western	32,993	172,180	106,224
United States	36,700	180,517	113,653

The requirements in 2000 are:

	Irrigated acreage	Storage and diversion	Irrigation water requirement
	Thousand acres	*Thousand acre-feet*	*Thousand acre-feet*
Eastern	15,068	29,178	26,589
Western	40,445	169,428	110,652
United States	55,513	198,606	137,241

Water requirements for high levels of population in 1980 and 2000

The irrigated acreage and water requirements for the high population level projections in 1980 and 2000 are shown in table 46.

The requirements in 1980 are:

	Irrigated acreage	Storage and diversion	Irrigation water requirement
	Thousand acres	*Thousand acre-feet*	*Thousand acre-feet*
Eastern	11,322	25,268	22,364
Western	39,279	199,478	122,756
United States	50,601	224,746	145,120

The requirements in 2000 are:

	Irrigated acreage	Storage and diversion	Irrigation water requirement
	Thousand acres	*Thousand acre-feet*	*Thousand acre-feet*
Eastern	30,661	59,532	53,790
Western	47,830	195,270	127,608
United States	78,491	254,802	181,398

Impacts of Forest Land Conversion

There will be competition for the use of lands that are needed to meet our growing needs for timber as well as those for food and feed crops. The detailed analysis of timber growth and potential demands, recently published in "Timber Resources for America's Future," indicates that sawtimber growth needed to meet prospective timber demands by the year 2000 is likely to be about 105 billion board feet, or about twice the present level. In view of this, significant conversions of commercial forest land to other uses should not be made without full realization that such conversions to other uses will adversely affect our future timber supplies.

The potential conversion of forest lands estimated as possibly necessary to meet food and fiber requirements for the high population level projected to the year 2000 would have major impacts on the Nation's supply of wood products. Conversion of 73 million acres of forest land to crop and pasture use would remove from timber production lands that might otherwise be producing about 26 billion board feet annually by the year 2000. This would amount to about one-fourth of our present and future timber-growing capacity.

More than three-fourths of all forest land estimated for possible conversion under the high level assumptions is located in the Ohio; Lower Mississippi; Lower Arkansas, White, and Red; and Southeast water resource regions. Most of this forest land estimated to have a high use as cropland consists of bottomland, and cove and lower slope sites having land capability classifications of I, II, or III. These lands in general have the highest timber-growing potential of all forest lands in the East.

The clearing of additional forest lands for urban and industrial development, highways, airports, reservoirs, parks, and other facilities might total more than 50 million acres by the year 2000 under the high population level assumption. The additional annual loss of timber growth on these lands might total as much as 12 billion board feet annually by the year 2000.

Thus, diversion of 123 million acres of forest land to other uses means removing from timber production about one-fourth of the land now available for growing timber products, and a potential growth loss of 38 billion board feet annually. This reduction in sawtimber growth would amount to more than a third of the growth reasonably attainable on all present commercial forest lands. This potential growth loss is estimated despite allowances for possible substitutions for certain wood products, and despite estimated increases in per-acre growth due to expected improvements in forest management.

If such losses in timber growth are incurred, it is evident that timber supplies will fall far short of demands, that upward pressures on timber prices will be greatly intensified, and that consumption of wood products in many uses will have to be drastically reduced.

It also must be realized that, in addition to timber, forest lands contribute valuable benefits such as wildlife, forest recreation, and protection of watersheds. The reduction of forest areas by 123 million acres would result in substantial losses of benefits from these important uses of forest land.

Limitations of Projections

As we have stated earlier, statistical calculations of future requirements and production potentials cannot have a high degree of accuracy. Small errors in projections of trends or efficiencies can make large differences in the final estimates. The projections in the report are of value chiefly as indicators of the direction of change in important variables affecting our future requirements and supplies of farm and forest products.

There are many factors whose future course cannot be measured or predicted with reliability. Time did not permit the study of other factors. To evaluate properly the findings of this report, the following items, among others, should be considered:

(1) It was not possible to take into account the effect of changes in price-cost relationships at the different levels of projected requirements. Some of the land and water developments included in the analysis would not be feasible at current price-cost relations. Changes in prices and costs that would make these developments feasible would in turn make profitable other production practices such as more intensive use of fertilizer. This whole situation points up the need for additional production research and programs to bring about more rapid adoption of new technology.

(2) The procedure used in the report may place undue emphasis on land and water development as a means of balancing production with projected requirements. In the time available yield projections could not be modified to take in account all adjustments in land use. The projections of yields are based on past trends in research results and in rate of adoption of improved practices by farmers. Increased production research could be the basis for further substantial increases in crop yields. There is some evidence that we have been too conservative in our long-term projections of the impact of new technology.

(3) The possibility of increasing production by changes in crop rotation systems has not been fully taken into account in our estimates.

(4) The effect on production potential of interregional shifts of crops has not been considered.

(5) Possible new substitutes and synthetics have not been considered in their effect either on composition of diets and food requirements or on production increases. The use of plastics for water conservation and the direct manufacture of synthetic food are examples.

(6) In addition, it is impossible to project major scientific breakthroughs that may occur over the next 40 years.

(7) Requirements for land and water might also be affected by different export and import situations that would arise from changes in price-cost relations and from changes in national and international policy.

(8) The desirability of the estimated substantial shifts of forest land to cropland to meet high population level food requirements was not analyzed completely nor considered fully from a policy standpoint.

(9) The possibility of increased multiple use of farm and forest land and water resources was not fully appraised. For example, estimated conversions of forest lands to strictly recreational uses are based upon the present situation and existing public concepts of needs. These may change as the national requirements for timber and recreation increase. Even now, forest areas are being increasingly utilized on a multiple-use basis. It is probable that in the future there will be greater use of forest lands for recreational use in combination with the production of timber. This multiple-use concept may also be applied to a much greater extent to farmlands and water resources, such as in the expanded use of private lands and water for hunting and fishing.

The provision of adequate farm and forest products for our future population must come from a broad effort on many fronts. The relative importance of alternative means of meeting future requirements will depend on the course of technical development. The goal is to select the means of production that are most economical in the use of our land, water, and labor resources.

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Table 1.- Population, labor force, employment and output, 1954 and 1958, and projections for 1980 and 2000

Item	Unit	1954	1958	Projections					
				1980			2000		
				Low	Medium	High	Low	Medium	High
Population 1/	Mil.	162.4	174.1	225	244	278	267	329	431
Labor force 2/	do.	67.8	71.3	97	102	110	122	142	175
Civilian employment	do.	60.9	64.0	88	95	105	110	132	168
Gross national product 3/	Bil.dol.	426.0	462.6	960	1,060	1,260	1,680	2,200	3,290

1/ Includes Armed Forces overseas.
2/ Includes Armed Forces.
3/ In estimated 1960 prices. For all goods this price level is 34 percent higher than the 1947-49 level. For farm goods the 1960 price is same level as in 1958, and 14 percent lower than the average level in 1947-49.

Projections provided by Resources for the Future, Inc.

Table 2.- Domestic requirements for farm products, 1954 and 1958, and projections for 1980 and 2000

(Index numbers, 1954 = 100)

Item	1954	1958	Projections					
			1980			2000		
			Low	Medium	High	Low	Medium	High
Population	100	107	139	150	171	164	203	265
Domestic utilization of all farm products	100	106	157	169	192	185	228	300
Food	100	107	155	167	189	182	225	296
Nonfood	100	101	171	185	211	202	250	329
Livestock products:								
Food	100	107	156	168	190	183	226	297
Meat animals	100	104	162	175	199	191	236	310
Dairy products	100	107	148	160	182	174	215	283
Poultry	100	129	168	182	206	198	245	322
Eggs	100	99	137	148	168	161	199	262
Nonfood	100	86	105	114	129	124	153	201
Crops:								
Food	100	107	152	165	188	180	222	292
Cereals and potatoes	100	102	129	136	151	169	196	239
Fruits and vegetables	100	113	164	176	201	193	238	314
Nonfood	100	113	138	150	171	159	196	256
Feed and seed	100	117	131	143	162	149	184	240
Other	100	100	164	177	201	193	238	314

Table 3.- Foreign commercial demand for selected United States agricultural products, average 1950-54, 1954 and 1956, and projections 1980 and 2000

Commodity	Unit	Exports 1/			Projections	
		Average 1950-54	1954	1956	1980	2000
Cotton	Mil. bales	4.0	3.8	7.6	7.6	9.0
Tobacco	Mil. lbs.	474	462	510	440	500
Wheat	Mil. bu.	330	274	546	390	695
Rice	Mil. cwt.	13.8	8.9	26.3	21	27
Feed grains	do.	100	155	136	305	315
Fats and oils 2/	Mil. lbs.	2,882	2,897	4,950	8,500	12,500
Index 3/	1950-51 to 1954-55 = 100	100	99	161	186	250

1/ Year beginning January 1 for tobacco, July 1 for wheat and feed grain, August 1 for cotton and rice, and October 1 for fats and oils.
2/ Including oil equivalent of oil seeds.
3/ Index calculated on market value basis.

Table 4.- Relative changes in farm product utilization, 1925-29 average, 1954 and 1958, and projections for 1980 and 2000

(Index numbers, 1954 = 100)

Item	Average 1925-29	1954	1958	Projections					
				1980			2000		
				Low	Medium	High	Low	Medium	High
Domestic utilization of farm products	68	100	106	157	169	192	185	228	300
Exports, total	92	100	136	172	172	172	225	225	225
Livestock exports	68	100	126	100	100	100	100	100	100
Crop exports	99	100	138	188	188	188	253	253	253
Imports, total	88	100	114	160	173	196	189	233	307
Livestock imports	95	100	159	160	173	196	189	233	307
Crop imports	86	100	105	160	173	196	189	233	307
Total utilization 1/	69	100	108	158	169	190	188	227	291
Livestock	68	100	104	150	161	182	175	220	283
Crop	78	100	107	148	159	177	176	209	265

1/ Domestic utilization, excluding stock changes, plus exports and minus imports.

Table 5.- Production of major crops, 1954 and 1958, and projected requirements 1980 and 2000

Commodity	Unit	Production		Projected requirements					
				1980			2000		
		1954	1958	Low	Medium	High	Low	Medium	High
Corn	Mil. bu.	3,058	3,800	4,310	4,643	5,234	4,862	5,912	7,617
Oats	do.	1,410	1,422	1,551	1,683	1,905	1,757	2,161	2,804
Barley	do.	379	470	720	769	858	815	977	1,237
Sorghums	do.	235	615	354	381	428	403	485	618
Hay	Mil. tons	108	122	137	149	170	159	197	257
Cotton	Thous. bales	13,890	12,059	21,296	22,247	24,507	25,241	29,059	35,240
Tobacco	Mil. lbs.	2,244	1,758	2,697	2,734	3,001	2,960	3,710	4,429
Wheat	Mil. bu.	984	1,462	1,217	1,287	1,411	1,676	1,906	2,280
Rye	do.	26	32	28	30	33	32	39	51
Rice (rough)	Mil. cwt.	53	43	64	66	71	78	85	103
Potatoes	do.	220	266	257	278	317	304	376	491
Sweetpotatoes	do.	17	17	27	28	32	31	39	50
Sugar (raw):									
Beets	Thous. tons	2,186	2,202	2,654	2,654	2,654	2,914	2,914	2,914
Cane	do.	610	579	757	757	757	830	830	830
Dry beans	Mil. lbs.	1,694	1,898	2,079	2,254	2,567	2,466	3,048	3,984
Soybeans	Mil. bu.	341	574	512	532	568	685	752	860
Flaxseed	do.	41	40	37	39	43	47	54	66
Peanuts (Farmers' stock)	Mil. lbs.	1,008	1,886	2,283	2,449	2,744	2,798	3,346	4,233
Cottonseed	Thous. tons	5,709	4,798	6,889	7,467	8,502	8,186	10,103	13,207

Table 6.- Farm output, 1954 and 1958, and projected requirements for 1980 and 2000 1/

(1947-49 dollars)

Type of output	1954	1958	Projections					
			1980			2000		
			Low	Medium	High	Low	Medium	High
	Million dollars	Million dollars	Million dollars	Million dollars	Million dollars	Million dollars	Million dollars	Million dollars
Total farm output 2/	30,177.9	34,367.1	45,977.9	49,352.0	55,519.7	54,661.2	66,252.2	85,068.3
Crop production:								
Fruits, nuts, and vegetables	3,033.6	3,264.7	4,975.1	5,339.1	6,097.5	5,854.8	7,220.0	9,525.5
Rice and sugarbeets	509.0	439.7	554.3	567.7	592.7	650.9	681.9	772.0
Wheat	2,031.1	3,020.9	2,512.5	2,656.7	2,912.6	3,459.0	3,934.2	4,706.1
Feed grains	6,523.1	8,289.2	9,111.9	9,835.8	11,063.0	10,295.6	12,510.1	16,102.3
All hay	2,372.6	2,688.6	3,023.0	3,276.6	3,732.1	3,504.3	4,327.6	5,656.3
Oil crops	1,038.0	1,865.9	1,730.1	1,809.8	1,951.9	2,274.4	2,538.3	2,965.1
All other crops	4,489.9	3,720.3	6,158.2	6,484.0	7,137.8	7,135.4	8,464.6	10,383.0
Total	19,997.3	23,289.3	28,065.1	29,969.7	33,487.6	33,174.4	39,676.7	50,110.3
Pasture production 3/	1,885.3	1,887.9	2,436.6	2,641.0	3,007.3	2,823.1	3,486.7	4,557.4
Product added by livestock	8,747.5	9,556.0	15,805.1	17,091.9	19,409.4	18,946.5	23,430.6	30,799.3

1/ Farm output is the annual volume of farm production available for eventual human use through sales from farms or consumption in farm households.

2/ Estimates of crop production include hay and concentrates fed to horses and mules, and production of hay and pasture seed. As these items are not included in farm output, the sum of crop production, pasture production, and product added by livestock exceeds the value of farm output.

3/ Based on rough approximations of value of feed equivalent units.

Table 7.- Crop yields per harvested acre, 1954, 1956-58, and projections for 1980 and 2000

Crop	Unit	1954	1956-58	Projections	
				1980	2000
Feed grains:					
Corn, all	Bushel	38.1	48.2	57	72
Oats	do.	34.8	38.8	44	52
Barley	do.	28.4	30.0	37	44
Sorghum grain	do.	20.1	30.4	37	46
Hay, all	Ton	1.46	1.60	1.90	2.20
Oil crops:					
Soybeans for beans	Bushel	20.0	23.1	27	32
Peanuts, picked and threshed	Pound	727	1,115	1,451	1,827
Flaxseed	Bushel	7.3	7.9	13	16
Food grains:					
Wheat, all	Bushel	18.1	23.2	25	31
Rice, rough	Cwt.	25	32.2	43	49
Rye	Bushel	14.4	15.9	20	22
Other food crops:					
Potatoes	Bushel	259	294	369	458
Beans, dry (cleaned)	Pound	1,105	1,177	1,377	1,524
Sweetpotatoes	Bushel	85	113	178	238
Tobacco	Pound	1,346	1,571	1,453	1,576
Cotton	Pound	341	419	539	716
All pasture 1/	Feed unit 2/	201	224	304	385
Cropland	do.	1,109	1,226	1,874	2,470
Open permanent in farms	do.	209	228	291	355
Woodland	do.	96	96	107	116
Grazing land not in farms	do.	57	57	63	68

1/ Excludes aftermath pasture acres and production. The average yield for all pasture for 1980 and 2000 was weighted by the pasture acreage in each type in 1956-58.

2/ A feed unit is equivalent to 1 pound of corn.

Table 8.- Value per harvested acre of production of specified crops in 1954, and projections for 1980 and 2000 with attainable yield increases and 1954 acreages

Commodity	1954 harvested crops	Value in 1947-49 dollars of production per harvested acre		
		1954	Projections	
			1980	2000
	Thousand acres	Dollars	Dollars	Dollars
Feed grains				
Corn	80,186	57.02	85.50	108.00
Oats	40,551	28.07	35.64	42.93
Barley	13,370	36.78	48.10	57.20
Sorghum grain	11,702	27.39	50.32	62.56
Total or average	145,809	44.74	65.38	81.60
Hay, all	73,721	32.18	41.88	48.49
Oil crops				
Soybeans	17,047	50.77	59.40	70.40
Peanuts (picked and threshed)	1,387	76.14	152.36	191.84
Flaxseed	5,663	37.67	67.06	82.56
Total or average	24,097	49.15	66.56	80.25
Food grains				
Wheat, all	54,356	37.37	51.50	63.86
Rice	2,550	124.31	213.71	243.53
Rye	1,795	24.74	34.40	37.84
Total or average	58,701	40.76	58.02	70.87
Other food:				
Potatoes	1,413	383.37	546.12	677.84
Beans, dry	1,533	94.06	117.18	129.69
Sweetpotatoes	332	205.72	430.76	575.96
Total or average	3,278	230.08	333.83	411.17
Tobacco	1,668	617.15	666.93	723.38
Cotton	19,251	125.14	197.81	262.77

Table 9.- Value of crop production in 1954, and projections for 1980 and 2000 with attainable yield increases and 1954 acreages, water resource regions

Water resource region	1954 harvested crops 1/	Value in 1947-49 dollars of production from harvested crops					
		1954		Projections 2/			
				1980		2000	
		Total	Per acre	Per acre	Total	Per acre	Total
	Acres	Thousand dollars	Dollars	Dollars	Thousand dollars	Dollars	Thousand dollars
Eastern:							
New England	2,405,510	259,965	108	122	293,252	137	329,117
Delaware and Hudson	3,896,286	399,946	103	129	503,065	150	583,866
Chesapeake Bay	7,667,390	519,930	68	83	636,094	97	746,387
Southeast	23,862,947	2,319,687	97	148	3,523,863	185	4,508,108
Eastern Great Lakes	10,056,456	739,900	74	92	923,229	107	1,079,971
Western Great Lakes	12,484,464	779,895	62	72	903,606	82	1,022,027
Ohio	26,266,726	1,639,779	62	84	2,220,202	103	2,711,344
Cumberland	1,823,988	119,984	66	88	159,805	106	194,286
Tennessee	4,068,962	239,968	59	81	328,742	99	402,179
Upper Mississippi	57,452,986	3,099,581	54	74	4,264,635	92	5,270,434
Lower Mississippi	10,171,063	1,099,852	108	178	1,807,382	232	2,360,680
Lower Missouri	13,847,516	499,932	36	50	693,298	61	845,911
Lower Arkansas, White, Red	9,543,062	399,946	42	76	720,916	113	1,076,026
Total	183,547,356	12,118,365	66	92	16,978,089	115	21,130,336
Western:							
Upper Missouri	86,895,584	2,619,646	30	39	3,373,535	46	3,987,228
Upper Arkansas, White, Red	25,977,811	799,892	31	48	1,257,887	75	1,950,587
Western Gulf	20,311,420	1,239,833	61	111	2,259,502	154	3,139,516
Upper Rio Grande-Pecos	1,540,542	179,975	117	149	230,234	171	263,962
Colorado	2,921,506	439,941	151	185	541,822	231	674,867
Great Basin	2,071,132	99,986	48	57	118,607	62	127,809
Pacific Northwest	10,927,052	919,876	84	102	1,109,186	115	1,252,685
Central Pacific	7,381,715	1,219,835	165	202	1,494,341	220	1,623,831
South Pacific	1,159,884	359,951	310	382	443,746	410	475,286
Total	159,186,644	7,878,935	49	68	10,828,860	85	13,495,771
United States	342,734,000	19,997,300	58	81	27,806,949	101	34,626,107

1/ Acreage of harvested crops include acreages of two or more crops harvested from same land in 1954. Thus, the acreages of harvested crops in instances are greater than the total cropland harvested.

2/ Regional variations in projected yields are estimated on basis of variations in yield potentials by 10 farm production regions.

Table 10.- Pasture production in 1954, and projections for 1980 and 2000 with attainable yield increases based on 1954 acreages and distribution of different types of pasture, by water resource regions

Water resource region	1954			1980		2000	
	All pasture acreage	Yield per acre 1/	Production	Yield per acre 1/	Production	Yield per acre 1/	Production
	Thousand acres	Pounds	Million pounds	Pounds	Million pounds	Pounds	Million pounds
Eastern:							
New England	3,437	347	1,192.2	572	1,964.9	732	2,517.4
Delaware and Hudson	2,830	643	1,820.3	1,205	3,410.8	1,586	4,487.6
Chesapeake Bay	6,759	506	3,421.9	1,036	6,999.7	1,387	9,377.9
Southeast	65,020	248	16,156.2	382	24,872.7	471	30,649.5
Eastern Great Lakes	5,828	509	2,966.1	781	4,553.1	970	5,654.7
Western Great Lakes	7,103	637	4,522.2	1,007	7,155.4	1,276	9,064.1
Ohio	23,804	610	14,524.0	997	23,734.7	1,269	30,203.6
Cumberland	4,023	454	1,828.5	888	3,572.8	1,193	4,799.7
Tennessee	9,219	411	3,790.0	801	7,387.7	1,068	9,849.7
Upper Mississippi	25,811	711	18,344.6	1,158	29,904.6	1,418	36,598.4
Lower Mississippi	19,154	267	5,118.0	422	8,092.3	530	10,149.1
Lower Missouri	14,154	548	7,762.9	890	12,601.4	1,119	15,836.6
Lower Arkansas, White, Red	45,823	249	11,400.7	352	16,121.8	439	20,134.5
Total	232,965	398	92,847.6	645	150,371.9	813	189,322.8
Western:							
Upper Missouri	198,649	201	40,026.3	231	45,978.6	286	56,929.6
Upper Arkansas, White, Red	65,321	218	14,250.3	304	19,831.5	361	23,602.2
Western Gulf	77,273	325	25,148.0	397	30,659.6	475	36,701.7
Upper Rio Grande-Pecos	77,444	69	5,344.8	131	10,138.3	170	13,149.5
Colorado	118,502	56	6,577.4	86	10,266.5	106	12,508.1
Great Basin	86,679	40	3,488.1	52	4,527.2	61	5,289.5
Pacific Northwest	94,763	74	7,067.3	112	10,634.4	140	13,302.6
Central Pacific	34,763	132	4,605.7	220	7,659.2	292	10,146.2
South Pacific	9,378	87	820.1	158	1,480.9	204	1,911.8
Total	762,772	141	107,328.0	185	141,176.2	228	173,541.2
United States	995,737	201	200,175.6	293	291,548.1	364	362,864.0

1/ Yield per acre in pounds of corn equivalent. Regional variations in yield potentials in 1980 and 2000 are based primarily on differences in 10 farm production regions.

Table 11.- Average acreage irrigated, selected years 1939-57, and acreage potentially irrigable in 1980 and 2000, water resource regions

Water resource region	1939	1949	1954	1957 1/	Projections			
					Potential I 2/		Potential II 3/	
					1980	2000	1980	2000
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Eastern:								
New England	3,000	31,236	37,909	44,984	62,800	108,000	130,700	181,000
Delaware and Hudson	13,673	45,797	115,774	137,384	191,800	329,600	302,800	443,900
Chesapeake Bay	2,535	7,305	35,251	41,831	58,400	100,400	138,300	204,600
Southeast	131,168	383,048	524,826	622,540	868,900	1,493,600	1,650,000	1,997,700
Eastern Great Lakes	3,596	8,341	23,127	27,431	38,200	65,600	64,300	93,900
Western Great Lakes	3,231	15,278	28,317	33,601	46,900	80,600	141,000	208,200
Ohio	4,684	9,144	35,334	41,928	58,500	100,600	184,400	272,000
Cumberland	---	---	4,059	4,816	6,700	11,600	7,000	12,000
Tennessee	36	422	20,485	24,307	33,900	58,300	34,000	60,000
Upper Mississippi	6,432	15,089	34,735	41,499	57,900	99,600	206,900	304,700
Lower Mississippi	106,466	225,431	536,795	636,994	889,100	1,528,300	1,024,000	1,531,500
Lower Missouri	811	1,024	8,009	9,503	13,300	22,800	38,100	56,300
Lower Arkansas, White, Red	117,209	296,498	597,472	708,998	989,600	1,701,000	990,000	1,750,000
Total	392,841	1,038,613	2,002,093	2,375,816	3,316,000	5,700,000	4,911,500	7,115,800
Western:								
Upper Missouri	3,689,752	4,500,542	4,621,702	5,368,901	5,505,100	7,577,000	8,147,000	9,778,700
Upper Arkansas, White, Red	590,745	1,048,151	1,409,402	1,637,240	1,632,200	1,961,600	1,823,000	2,201,600
Western Gulf	1,077,599	3,037,268	4,431,503	5,147,944	5,103,100	6,179,300	5,516,800	7,071,100
Upper Rio Grande-Pecos	805,365	1,160,475	1,132,222	1,315,246	1,403,000	1,640,000	1,464,100	1,648,600
Colorado	2,773,000	3,485,031	2,813,311	3,268,144	3,300,000	3,500,000	3,300,000	3,500,000
Great Basin	1,167,536	1,430,759	1,935,702	2,248,649	2,250,000	2,400,000	2,300,000	2,400,000
Pacific Northwest	3,304,531	3,836,538	4,353,180	5,056,956	5,060,000	5,813,500	5,903,900	7,729,800
Central Pacific	3,702,607	5,528,931	6,063,656	7,043,970	7,182,300	7,800,000	7,334,700	7,869,900
South Pacific	479,024	721,147	789,384	917,177	930,600	990,000	953,400	999,400
Total	17,590,159	24,748,842	27,550,062	32,004,227	32,366,300	37,861,400	36,742,900	43,218,100
United States	17,983,000	25,787,455	29,552,155	34,380,043	35,682,300	43,561,400	41,654,400	50,333,900

1/ Estimated on basis of preliminary data.

2/ Estimated for U. S. Department of Agriculture unpublished report, "A 50-Year Look Ahead at U. S. Agriculture," prepared in June 1959. Based in part on appraisal of production needs and accomplishments contained in U. S. Dept. Agr. Agr. Inf. Bul. 40, "Agricultural Land Resources," June 1955. U. S. data distributed to water resource regions in accordance with irrigation acreages in 1957.

3/ For Eastern regions, a straight-line projection of irrigation trend 1939 to 1957. For Western regions, 1980 potential is based on 1957 acreage plus U. S. Bureau of Reclamation proposed project acreages; 2000 potential is based on 1957 acreage plus U. S. Bureau of Reclamation proposed project acreages and all foreseeable future projects for which data are available, as listed in the 1958 report of the Commissioner of the Bureau of Reclamation.

Table 12.- Crop production from irrigated and nonirrigated land in 1954, and projections for 1980 and 2000 with attainable yield increases under irrigation potential I with 1954 acreages and crop distributions 1/

Water resource region	1954						
	Harvested crops			Value of crop production, 1947-49 dollars			Production from irrigated crops
	Irrigated	Nonirrigated	Total	Irrigated	Nonirrigated	Total	
	Acres	Acres	Acres	Thous. dollars	Thous. dollars	Thous. dollars	Percent
Eastern:							
New England	45,100	2,360,410	2,405,510	35,875	224,090	259,965	13.8
Delaware and Hudson	117,249	3,779,037	3,896,286	69,990	329,956	399,946	17.5
Chesapeake Bay	30,264	7,637,126	7,667,390	12,478	507,452	519,930	2.4
Southeast	363,145	23,499,802	23,862,947	171,657	2,148,030	2,319,687	7.4
Eastern Great Lakes	22,982	10,033,474	10,056,456	11,098	728,802	739,900	1.5
Western Great Lakes	27,837	12,456,627	12,484,464	11,689	768,206	779,895	1.5
Ohio	33,529	26,233,197	26,266,726	9,839	1,629,940	1,639,779	0.6
Cumberland	2,963	1,821,025	1,823,988	720	119,264	119,984	0.6
Tennessee	14,908	4,054,054	4,068,962	4,079	235,889	239,968	1.7
Upper Mississippi	34,503	57,418,483	57,452,986	12,398	3,087,183	3,099,581	0.4
Lower Mississippi	514,461	9,656,602	10,171,063	93,487	1,006,365	1,099,852	8.5
Lower Missouri	7,340	13,840,176	13,847,516	500	499,432	499,932	0.1
Lower Arkansas, White, Red	98,365	9,444,697	9,543,062	7,999	391,947	399,946	2.0
Total	1,312,646	182,234,710	183,547,356	441,809	11,676,556	12,118,365	3.6
Western:							
Upper Missouri	4,062,892	82,832,692	86,895,584	261,965	2,357,681	2,619,646	10.0
Upper Arkansas, White, Red	1,323,126	24,654,685	25,977,811	126,383	673,509	799,892	15.8
Western Gulf	4,388,768	15,922,652	20,311,420	617,437	622,396	1,239,833	49.8
Upper Rio Grande-Pecos	1,102,778	437,764	1,540,542	171,516	8,459	179,975	95.3
Colorado	2,587,203	334,303	2,921,506	430,262	9,679	439,941	97.8
Great Basin	1,337,709	733,423	2,071,132	77,989	21,997	99,986	78.0
Pacific Northwest	3,307,591	7,619,461	10,927,052	458,098	461,778	919,876	49.8
Central Pacific	5,328,220	2,053,493	7,381,713	1,071,015	148,820	1,219,835	87.8
South Pacific	702,397	457,487	1,159,884	292,280	67,671	359,951	81.2
Total	24,140,684	135,045,960	159,186,644	3,506,945	4,371,990	7,878,935	44.5
United States	25,453,330	317,280,670	342,734,000	3,948,754	16,048,546	19,997,300	19.7

See footnote at end of table.

- Continued

Table 12.- Crop production from irrigated and nonirrigated land in 1954, and projections for 1980 and 2000 with attainable yield increases under irrigation potential I with 1954 acreages and crop distributions 1/ - continued

Water resource region	1980						
	Harvested crops			Value of crop production, 1947-49 dollars			Production from irrigated crops
	Irrigated	Nonirrigated	Total	Irrigated	Nonirrigated	Total	
	Acres	Acres	Acres	Thous. dollars	Thous. dollars	Thous. dollars	Percent
Eastern:							
New England	60,085	2,345,425	2,405,510	51,673	241,579	293,252	17.6
Delaware and Hudson	184,805	3,711,481	3,896,286	117,536	385,529	503,065	23.4
Chesapeake Bay	47,398	7,619,992	7,667,390	26,495	609,599	636,094	4.2
Southeast	615,275	23,247,672	23,862,947	431,923	3,091,940	3,523,863	12.2
Eastern Great Lakes	36,368	10,020,088	10,056,456	21,421	901,808	923,229	2.3
Western Great Lakes	45,525	12,438,939	12,484,464	20,441	883,165	903,606	2.3
Ohio	51,483	26,215,243	26,266,726	18,122	2,202,080	2,220,202	.8
Cumberland	4,800	1,819,188	1,823,988	1,536	158,269	159,805	1.0
Tennessee	24,232	4,044,730	4,068,962	9,208	319,534	328,742	2.8
Upper Mississippi	56,283	57,396,703	57,452,986	27,279	4,147,356	4,264,635	.4
Lower Mississippi	870,516	9,300,547	10,171,063	254,191	1,553,191	1,807,382	14.1
Lower Missouri	11,988	13,835,528	13,847,516	1,522	691,776	693,298	.2
Lower Arkansas, White, Red	986,126	8,556,936	9,543,062	139,044	581,872	720,916	19.3
Total	2,994,884	180,552,472	183,547,356	1,120,391	15,857,698	16,978,089	6.5
Western:							
Upper Missouri	4,542,489	82,353,095	86,895,584	408,824	2,964,711	3,373,535	12.1
Upper Arkansas, White, Red	1,479,284	24,498,527	25,977,811	81,958	1,175,929	1,257,887	6.5
Western Gulf	4,906,845	15,404,575	20,311,420	1,211,991	1,047,511	2,259,502	53.6
Colorado	1,252,924	287,618	1,540,542	223,159	7,075	230,234	96.9
Great Basin	2,766,535	154,971	2,921,506	536,708	5,114	541,822	99.0
Pacific Northwest	1,537,252	533,880	2,071,132	99,921	18,686	118,607	84.2
Central Pacific	3,868,451	7,058,601	10,927,052	615,084	494,102	1,109,186	55.4
South Pacific	5,957,158	1,424,555	7,381,713	1,376,103	118,238	1,494,341	92.1
Total	785,359	374,525	1,159,884	379,328	64,418	443,746	85.5
	27,096,297	132,090,347	159,186,644	4,933,076	5,895,784	10,828,860	45.6
United States	30,091,181	312,642,819	342,734,000	6,053,467	21,753,482	27,806,949	21.7

See footnote at end of table.

- Continued

Table 12.- Crop production from irrigated and nonirrigated land in 1954, and projections for 1980 and 2000 with attainable yield increases under irrigation potential I with 1954 acreages and crop distributions 1/ - continued

Water resource region	2000						
	Harvested crops			Value of crop production, 1947-49 dollars			Production from irrigated crops
	Irrigated	Nonirrigated	Total	Irrigated	Nonirrigated	Total	
	Acres	Acres	Acres	Thous. dollars	Thous. dollars	Thous. dollars	Percent
Eastern:							
New England	103,330	2,302,180	2,405,510	89,690	239,427	329,117	27.2
Delaware and Hudson	317,580	3,578,706	3,896,286	203,569	380,297	583,866	35.3
Chesapeake Bay	81,485	7,585,905	7,667,390	48,484	697,903	746,387	6.5
Southeast	1,057,630	22,805,317	23,862,947	882,063	3,626,045	4,508,108	19.6
Eastern Great Lake	62,454	9,994,002	10,056,456	40,595	1,039,376	1,079,971	3.8
Western Great Lakes	78,237	12,406,227	12,484,464	41,935	980,092	1,022,027	4.1
Ohio	88,534	26,178,192	26,266,726	41,168	2,670,176	2,711,344	1.5
Cumberland	8,311	1,815,677	1,823,988	3,640	190,646	194,286	1.9
Tennessee	41,674	4,027,288	4,068,962	19,587	382,592	402,179	4.9
Upper Mississippi	96,818	57,356,168	57,452,986	51,023	5,219,411	5,270,434	1.0
Lower Mississippi	1,496,355	8,674,708	10,171,063	547,656	1,813,014	2,360,680	23.2
Lower Missouri	20,551	13,826,965	13,847,516	3,466	842,445	845,911	.4
Lower Arkansas, White, Red	1,695,029	7,848,033	9,543,062	393,247	682,779	1,076,026	36.5
Total	5,147,988	178,399,368	183,547,356	2,366,133	18,764,203	21,130,336	11.2
Western:							
Upper Missouri	6,252,100	80,643,484	86,895,584	600,202	3,387,026	3,987,228	15.0
Upper Arkansas, White, Red	1,777,823	24,199,988	25,977,811	401,788	1,548,799	1,950,587	20.6
Western Gulf	5,930,313	14,381,107	20,311,420	1,873,979	1,265,537	3,139,516	59.7
Upper Rio Grande-Pecos	1,448,714	91,828	1,540,542	262,217	1,745	263,962	99.3
Colorado	2,914,204	7,302	2,921,506	674,575	292	674,867	100.0
Great Basin	1,639,735	431,397	2,071,132	110,985	16,824	127,809	86.8
Pacific Northwest	4,444,514	6,482,538	10,927,052	760,012	492,673	1,252,685	60.7
Central Pacific	6,469,492	912,221	7,381,713	1,541,731	82,100	1,623,831	94.9
South Pacific	835,488	324,396	1,159,884	417,744	57,542	475,286	87.9
Total	31,712,383	127,474,261	159,186,644	6,643,233	6,852,538	13,495,771	49.2
United States	36,860,371	305,873,629	342,734,000	9,009,366	25,616,741	34,626,107	26.0

1/ The breakdown of crops harvested as reported by the Crop Reporting Board between irrigated and nonirrigated crops is based primarily on irrigated and nonirrigated acreages and yields as reported by the 1954 Census of Agriculture. The relative differences in yield between irrigated and nonirrigated land in 1954 were generally maintained in estimating attainable crop production in 1980 and 2000. Acreages of crops harvested include acreages of two or more crops harvested from same land in 1954. Thus, the acreages of crops harvested irrigated in instances are greater than acreages of land irrigated, and total crops harvested greater than total cropland harvested.

Table 13.- Average value of crop production per acre, irrigated and nonirrigated, 1954, and projected for 1980 and 2000

Water resource region	Value of crop production per acre, 1947-49 dollars								
	Total acreage			Irrigated acreage			Nonirrigated acreage		
	1954	1980	2000	1954	1980	2000	1954	1980	2000
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Eastern:									
New England	108	122	137	795	860	868	95	103	104
Delaware and Hudson	103	129	150	597	636	641	87	102	106
Chesapeak Bay	68	83	97	412	559	595	66	80	92
Southeast	97	148	185	473	702	834	91	133	159
Eastern Great Lakes	74	92	107	483	589	650	73	90	104
Western Great Lakes	62	72	82	420	449	536	62	71	79
Ohio	62	84	103	293	352	465	62	84	102
Cumberland	66	88	106	243	320	438	65	87	105
Tennessee	59	81	99	274	380	470	58	79	95
Upper Mississippi	54	74	92	359	485	527	54	74	91
Lower Mississippi	108	178	232	182	292	366	104	167	209
Lower Missouri	36	50	61	68	127	169	36	50	61
Lower Arkansas, White, Red	42	76	113	81	141	232	41	68	87
All Eastern regions	66	92	115	336	374	459	54	88	105
Western:									
Upper Missouri	30	39	46	64	90	96	28	36	42
Upper Arkansas, White, Red	31	48	75	96	171	226	27	48	64
Western Gulf	61	111	154	141	247	316	39	68	88
Upper Rio Grande-Pecos	117	149	171	156	178	181	19	24	29
Colorado	151	185	231	166	194	231	29	33	40
Great Basin	48	57	62	58	65	68	30	35	39
Pacific Northwest	84	102	115	138	159	171	61	70	76
Central Pacific	165	202	220	201	231	239	72	83	90
South Pacific	310	382	410	416	483	500	148	172	178
All Western regions	49	68	85	145	182	209	32	45	54
United States	58	81	101	156	201	244	50	70	84

Table 14.- Pasture production from irrigated and nonirrigated pasture land in 1954, and projections for 1980 and 2000 with attainable yield increases under irrigation potential I with 1954 acreage and distribution of different types of pasture land, by water resource regions 1/

Water resource region	1954						
	All pasture acreage			Production			
	Irrigated	Non-irrigated	Total	Irrigated	Non-irrigated	Total	Percentage from irrigated pasture
	Thous. acres	Thous. acres	Thous. acres	Mil. lbs.	Mil. lbs.	Mil. lbs.	Percent
Eastern:							
New England	1.6	3,435.4	3,437	3	1,189	1,192	0.25
Delaware and Hudson	4.2	2,825.8	2,830	10	1,810	1,820	.54
Chesapeake Bay	6.7	6,752.3	6,759	14	3,408	3,422	.40
Southeast	153.2	64,866.8	65,020	303	15,853	16,156	1.87
Eastern Great Lakes	1.1	5,826.9	5,828	2	2,964	2,966	.06
Western Great Lakes	.8	7,102.2	7,103	2	4,520	4,522	.04
Ohio	3.4	23,800.6	23,804	8	14,516	14,524	.05
Cumberland	1.2	4,021.8	4,023	2	1,827	1,829	.10
Tennessee	5.8	9,213.2	9,219	11	3,779	3,790	.29
Upper Mississippi	1.0	25,810.0	25,811	3	18,342	18,345	.01
Lower Mississippi	11.2	19,142.8	19,154	21	5,097	5,118	.41
Lower Missouri	.8	14,153.2	14,154	2	7,761	7,763	.02
Lower Arkansas, White, Red	2.1	45,820.9	45,823	5	11,396	11,401	.04
Total	193.1	232,771.9	232,965	386	92,462	92,848	.41
Western:							
Upper Missouri	808.1	197,840.9	198,649	1,952	38,075	40,027	4.87
Upper Arkansas, White, Red	132.0	65,189.0	65,321	394	13,856	14,250	2.76
Western Gulf	170.4	77,102.6	77,273	449	24,699	25,148	1.78
Upper Rio Grande-Pecos	137.3	77,306.7	77,444	317	5,028	5,348	5.92
Colorado	454.8	118,047.2	118,502	730	5,847	6,577	11.09
Great Basin	613.2	86,065.8	86,679	548	2,940	3,488	15.71
Pacific Northwest	1,025.1	93,737.9	94,763	2,157	4,910	7,067	30.52
Central Pacific	1,034.3	33,728.7	34,763	2,630	1,976	4,606	57.09
South Pacific	123.2	9,254.8	9,378	360	460	820	43.90
Total	4,498.4	758,273.6	762,772	9,537	97,791	107,331	8.88
United States	4,691.5	991,045.5	995,737	9,923	190,253	200,179	4.96

- Continued

See footnote at end of table.

Table 14.- Pasture production from irrigated and nonirrigated pasture land in 1954, and projections for 1980 and 2000 with attainable yield increases under irrigation potential I with 1954 acreage and distribution of different types of pasture land, by water resource regions 1/ - continued

Water resource region	1980						
	All pasture acreage			Production			
	Irrigated	Non-irrigated	Total	Irrigated	Non-irrigated	Total	Percentage from irrigated pasture
	Thous. acres	Thous. acres	Thous. acres	Mil. lbs.	Mil. lbs.	Mil. lbs.	Percent
Eastern:							
New England	2.7	3,434.3	3,437	8	1,957	1,965	0.48
Delaware and Hudson	7.0	2,823.0	2,830	29	3,381	3,410	.85
Chesapeake Bay	11.0	6,748.0	6,759	47	6,953	7,000	.67
Southeast	253.6	64,766.4	65,020	820	24,053	24,873	3.29
Eastern Great Lakes	1.8	5,826.2	5,828	6	4,547	4,553	.13
Western Great Lakes	1.4	7,101.6	7,103	4	7,151	7,155	.05
Ohio	7.0	23,797.0	23,804	27	23,708	23,735	.11
Cumberland	1.9	4,021.1	4,023	7	3,566	3,573	.19
Tennessee	9.7	9,209.3	9,219	41	7,347	7,388	.56
Upper Mississippi	1.6	25,809.4	25,811	8	29,897	29,905	.02
Lower Mississippi	18.6	19,135.4	19,154	59	8,034	8,093	.72
Lower Missouri	1.3	14,152.7	14,154	5	12,595	12,600	.03
Lower Arkansas, White, Red	3.5	45,819.5	45,823	13	16,109	16,122	.08
Total	321.1	232,643.9	232,965	1,074	149,298	150,372	.71
Western:							
Upper Missouri	962.6	197,686.4	198,649	3,702	42,277	45,979	8.05
Upper Arkansas, White, Red	152.9	65,168.1	65,321	745	19,087	19,832	3.76
Western Gulf	196.3	77,076.7	77,273	855	29,805	30,660	2.79
Upper Rio Grande-Pecos	170.1	77,273.9	77,444	733	9,406	10,139	7.23
Colorado	533.5	117,968.5	118,502	873	9,393	10,266	8.50
Great Basin	479.2	86,199.8	86.679	1,504	3,023	4,527	33.22
Pacific Northwest	1,191.6	93,571.4	94,763	3,955	6,679	10,634	37.19
Central Pacific	1,225.1	33,537.9	34,763	4,858	2,801	7,659	63.43
South Pacific	145.2	9,232.8	9,378	666	814	1,480	45.00
Total	5,056.5	757,715.5	762,772	17,891	123,285	141,176	12.67
United States	5,377.6	990,359.4	995,737	18,965	272,583	291,548	6.96

See footnote at end of table.

- Continued

Table 14.- Pasture production from irrigated and nonirrigated pasture land in 1954, and projections for 1980 and 2000 with attainable yield increases under irrigation potential I with 1954 acreage and distribution of different types of pasture land, by water resource regions 1/ - continued

Water resource region	2000						
	All pasture acreage			Production			
	Irrigated	Non-irrigated	Total	Irrigated	Non-irrigated	Total	Percentage from irrigated pasture
	Thous. acres	Thous. acres	Thous. acres	Mil. lbs.	Mil. lbs.	Mil. lbs.	Percent
Eastern:							
New England	4.7	3,432.3	3,437	17	2,500	2,517	.68
Delaware and Hudson	12.0	2,818.0	2,830	66	4,421	4,487	1.47
Chesapeake Bay	19.0	6,740.0	6,759	110	9,268	9,378	1.17
Southeast	436.0	64,584.0	65,020	1,777	28,873	30,650	5.80
Eastern Great Lakes	3.1	5,824.9	5,828	12	5,643	5,655	.21
Western Great Lakes	2.4	7,100.6	7,103	10	9,054	9,064	.11
Ohio	12.0	23,792.0	23,804	60	30,143	30,203	.20
Cumberland	3.3	4,019.7	4,023	17	4,783	4,800	.35
Tennessee	16.6	9,202.4	9,219	96	9,754	9,850	.97
Upper Mississippi	2.8	25,808.2	25,811	18	36,581	36,599	.05
Lower Mississippi	31.9	19,122.1	19,154	132	10,017	10,149	1.30
Lower Missouri	2.2	14,151.8	14,154	12	15,825	15,837	.08
Lower Arkansas, White, Red	6.0	45,817.0	45,823	29	20,105	20,134	.14
Total	552.0	232,413.0	232,965	2,356	186,967	189,323	1.24
Western:							
Upper Missouri	1,157.0	197,492.0	198,649	5,751	51,179	56,930	10.10
Upper Arkansas, White, Red	183.8	65,137.2	65,321	1,201	22,401	23,602	5.09
Western Gulf	235.9	77,037.1	77,273	1,321	35,381	36,702	3.60
Upper Rio Grande-Pecos	204.4	77,239.6	77,444	1,005	12,144	13,149	7.64
Colorado	565.8	117,936.2	118,502	939	11,569	12,508	7.51
Great Basin	479.2	86,199.8	86,679	1,601	3,688	5,289	30.27
Pacific Northwest	1,369.0	93,394.0	94,763	5,603	7,700	13,303	42.12
Central Pacific	1,472.4	33,290.6	34,763	6,960	3,186	10,146	68.60
South Pacific	174.5	9,203.5	9,378	955	957	1,912	49.95
Total	5,842.0	756,930.0	762,772	25,336	148,205	173,541	14.60
United States	6,394.0	989,343.0	995,737	27,692	335,172	362,864	7.63

1/ Production in pounds of corn equivalent.

Table 15.- Average value of pasture production per acre, irrigated and nonirrigated, 1954 and projected for 1980 and 2000 1/

Water resource region	Value of pasture production per acre, 1947-49 dollars								
	Total acreage			Irrigated acreage			Nonirrigated acreage		
	1954	1980	2000	1954	1980	2000	1954	1980	2000
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Eastern:									
New England	3.93	6.48	8.29	20.74	33.15	40.68	3.92	6.43	8.17
Delaware and Hudson	6.35	11.90	15.66	28.18	40.74	53.74	6.32	11.76	15.35
Chesapeake Bay	4.85	9.93	13.29	20.18	40.72	55.19	4.84	9.83	13.06
Southeast	2.29	3.53	4.35	18.28	29.74	39.88	2.26	3.42	4.27
Eastern Great Lakes	5.03	7.71	9.58	18.03	32.20	34.33	5.02	7.67	8.75
Western Great Lakes	5.80	9.18	11.64	21.69	26.18	38.09	5.80	9.15	11.52
Ohio	5.56	9.09	11.57	21.30	34.92	44.92	5.56	9.05	11.44
Cumberland	4.24	8.30	11.15	16.51	34.21	47.73	4.24	8.25	11.02
Tennessee	3.84	7.49	9.98	20.71	39.51	53.47	3.83	7.42	9.82
Upper Mississippi	6.40	10.42	12.76	27.84	44.53	57.51	6.40	10.38	12.17
Lower Mississippi	2.64	4.17	5.23	18.45	31.21	40.41	2.63	4.13	5.12
Lower Missouri	5.03	8.17	10.27	22.78	35.06	48.46	5.03	8.13	10.16
Lower Arkansas, White, Red-	2.31	3.27	4.08	22.41	34.54	44.72	2.31	3.25	4.04
Average	3.70	5.99	7.55	18.83	31.05	41.45	3.69	5.98	7.46
Western:									
Upper Missouri	1.79	2.05	2.54	21.48	34.05	43.78	1.71	1.89	2.28
Upper Arkansas, White, Red-	1.99	2.77	3.29	27.21	44.24	59.04	1.94	2.66	3.11
Western Gulf	2.98	3.64	4.36	24.17	39.80	50.90	2.94	3.53	4.33
Upper Rio Grande-Pecos	.69	1.31	1.70	23.08	42.89	48.68	.65	1.21	1.56
Colorado	.63	.77	1.20	18.18	27.83	34.53	.56	.85	1.02
Great Basin	.44	.57	.67	22.24	38.29	46.56	.28	.36	.40
Pacific Northwest	.81	1.22	1.53	22.97	36.08	44.26	.57	.78	.89
Central Pacific	1.55	2.58	3.43	29.84	46.34	54.96	.92	.96	1.11
South Pacific	1.02	1.85	2.39	34.30	53.59	63.61	.58	1.03	1.21
Average	1.34	1.76	2.17	24.18	38.64	47.40	1.21	1.53	1.83
United States	1.83	2.67	3.32	23.96	38.19	46.89	1.79	2.56	3.15

1/ Preliminary estimates derived by combining separate utilization estimates on cropland pasture, open permanent pasture, woodland pasture, and grazing land not in farms. Irrigated acreage is mainly cropland pasture.

Table 16.- Distribution of land by capability classes, water resource regions 1/

Water resource region	Class I	Class II	Class III	Classes I, II, and III	Class IV	Class V	Class VI	Class VII	Class VIII	Unclassified	Total land area
	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres
Eastern:											
New England	0.6	3.9	3.0	7.5	5.2	---	12.6	9.4	0.1	2.5	37.3
Delaware and Hudson	.8	3.9	4.9	9.6	2.0	0.2	3.4	3.7	.1	3.4	22.4
Chesapeake Bay	1.1	6.4	10.6	18.1	4.4	1.7	3.5	8.4	.2	4.6	40.9
Southeast	5.6	30.8	47.7	84.1	17.7	19.3	9.7	21.7	.1	16.2	168.8
Eastern Great Lakes	2.7	7.6	5.6	15.9	2.9	.2	4.2	3.5	.1	3.5	30.3
Western Great Lakes	4.1	10.0	8.1	22.2	4.5	1.8	2.1	5.6	.2	20.3	56.7
Ohio	6.5	18.4	18.5	43.4	9.2	.7	8.9	22.8	.2	5.8	91.0
Cumberland	.3	2.4	2.0	4.7	1.5	---	1.2	3.2	---	.6	11.2
Tennessee	.8	3.7	5.3	9.8	3.5	.2	2.5	9.5	.2	1.2	26.9
Upper Mississippi	16.1	29.6	22.6	68.3	9.5	2.0	8.3	9.6	.3	17.7	115.7
Lower Mississippi	2.2	8.5	11.6	22.3	2.9	6.2	1.5	2.3	---	3.5	38.7
Lower Missouri	3.7	5.5	9.3	18.5	.4	.3	4.0	3.9	.1	3.0	34.2
Lower Arkansas, White, Red-	3.6	9.9	18.3	31.8	6.2	4.9	9.3	15.0	.1	3.2	70.5
Total	48.1	140.6	167.5	356.2	73.9	37.5	71.2	118.6	1.7	85.5	744.6
Western:											
Upper Missouri	7.8	47.5	47.9	103.2	23.8	8.0	89.2	78.1	2.4	18.3	323.0
Upper Arkansas, White, Red-	5.7	17.0	23.5	46.2	8.1	1.7	20.9	26.9	1.2	4.1	109.1
Western Gulf	6.9	24.3	28.8	60.0	7.9	9.7	18.3	19.5	.1	5.6	121.1
Upper Rio Grande-Pecos	.4	3.3	2.8	6.5	1.8	2.9	25.6	45.2	3.0	3.2	88.2
Colorado	.2	.8	1.2	2.2	1.0	3.6	33.1	86.0	14.6	15.2	155.7
Great Basin	.1	.9	1.3	2.3	1.0	1.2	26.9	63.0	11.2	6.2	111.8
Pacific Northwest	.6	5.9	8.8	15.3	8.8	1.6	65.8	57.0	1.6	7.6	157.7
Central Pacific	1.4	3.9	5.0	10.3	4.9	.8	15.3	24.5	2.2	8.3	66.3
South Pacific	.1	.8	1.0	1.9	.7	---	3.0	13.4	.8	6.5	26.3
Total	23.2	104.4	120.3	247.9	58.0	29.5	298.1	413.6	37.1	75.0	1,159.2
United States	71.3	245.0	287.8	604.1	131.9	67.0	369.3	532.2	38.8	160.5	1,903.8

1/ Full potential based on physical capability of the land. It does not necessarily follow that all land physically suitable for cultivation should be used for cultivated crops, as a balanced enterprise on most existing farms requires use of some land in class I, II, or III for pasture or woodland. Estimates were compiled in 1948-49 by the Soil Conservation Service (includes both privately owned and publicly owned land). Allocation by water resource regions was made by the Agricultural Research Service.

Table 17.- Potential shifts in major land uses, by water resource regions, 1948-49 1/

Water resource region	Shifts to more intensive use		Shifts to less intensive use
	Grassland to cropland, classes I-III	Woodland to cropland, classes I-III	Cropland to grassland, woodland, and wildlife uses, classes V-VIII 2/
	Mil. acres	Mil. acres	Mil. acres
Eastern:			
New England	0.6	3.6	0.2
Delaware and Hudson	1.3	3.2	.4
Chesapeake Bay	2.2	7.1	.7
Southeast	9.2	40.9	3.1
Eastern Great Lakes	2.4	2.6	.6
Western Great Lakes	2.4	3.3	2.5
Ohio	6.2	7.2	2.7
Cumberland	.6	1.2	.4
Tennessee	1.2	2.7	.8
Upper Mississippi	9.5	4.0	4.4
Lower Mississippi	2.3	8.2	.8
Lower Missouri	2.9	1.2	1.3
Lower Arkansas, White, Red	5.6	9.8	2.0
Total	46.4	95.0	19.9
Western:			
Upper Missouri	22.3	1.6	10.4
Upper Arkansas, White, Red	12.4	1.9	5.2
Western Gulf	23.1	8.6	3.0
Upper Rio Grande-Pecos	2.0	---	.5
Colorado	.4	---	.1
Great Basin	.2	---	.0
Pacific Northwest	1.5	.7	.4
Central Pacific	2.4	---	.2
South Pacific	.1	---	.1
Total	64.4	12.8	19.9
United States	110.8	107.8	39.8

1/ Estimates compiled in 1948-49 by Soil Conservation Service (includes both privately owned and publicly owned land). Allocation by water resource regions was made by the Agricultural Research Service. Potential shifts apply to physical potential. The full realization of such shifts (particularly to more intensive use) is not necessarily recommended or economically desirable under present conditions.

2/ Only a small acreage of cropland suggested to be shifted to woodland. In the President's Materials Policy Commission Report, about 5.5 million acres of grassland are classified for potential shifts to wildlife purposes.

Table 18.- Grassland and woodland requiring drainage if converted to cropland, eastern water resource regions 1/

Water resource region	Grassland	Woodland	Total
	Thous. acres	Thous. acres	Thous. acres
New England	129	676	805
Delaware and Hudson	346	700	1,046
Chesapeake Bay	674	1,800	2,474
Southeast	1,850	13,379	15,229
Eastern Great Lakes	680	600	1,280
Western Great Lakes	841	642	1,483
Ohio	1,073	1,581	2,654
Cumberland	55	179	234
Tennessee	234	468	702
Upper Mississippi	2,309	1,199	3,508
Lower Mississippi	859	1,862	2,721
Lower Missouri	370	256	626
Lower Arkansas, White, Red	675	1,358	2,033
Total	10,095	24,700	34,795

1/ Includes grassland and woodland which is in land capability classes II and III and which is in the excess water subclass. Estimates compiled in 1948-49 by Soil Conservation Service (includes both privately owned and publicly owned land). Allocation by water resource regions was made by the Agricultural Research Service. Potential shifts apply to physical potential. The full realization of such shifts (particularly to more intensive use) is not necessarily recommended or economically desirable under present conditions.

Table 19.- Potential shifts of grassland pasture and woodland to cropland, by water resource regions, 1948-49 1/

Water resource region	Grassland to cropland				Woodland to cropland			
	Class I	Class II	Class III	Total, classes I-III	Class I	Class II	Class III	Total, classes I-III
	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres
Eastern:								
New England	0	0.3	0.3	0.6	0.2	1.8	1.6	3.6
Delaware and Hudson	.1	.5	.7	1.3	.2	1.1	1.9	3.2
Chesapeake Bay	.2	.6	1.4	2.2	.3	2.3	4.5	7.1
Southeast	.5	2.9	5.8	9.2	2.0	13.6	25.3	40.9
Eastern Great Lakes	.3	1.0	1.1	2.4	.3	1.1	1.2	2.6
Western Great Lakes	.4	.9	1.1	2.4	.7	1.2	1.4	3.3
Ohio	.7	2.1	3.4	6.2	.7	2.7	3.8	7.2
Cumberland	.0	.3	.3	.6	.1	.5	.6	1.2
Tennessee	.1	.4	.7	1.2	.1	.9	1.7	2.7
Upper Mississippi	1.8	3.7	4.0	9.5	.5	1.5	2.0	4.0
Lower Mississippi	.2	.8	1.3	2.3	.5	2.2	5.5	8.2
Lower Missouri	.5	.8	1.6	2.9	.3	.2	.7	1.2
Lower Arkansas, White, Red	.5	1.5	3.6	5.6	.9	2.5	6.4	9.8
Total	5.3	15.8	25.3	46.4	6.8	31.6	56.6	95.0
Western:								
Upper Missouri	1.4	8.1	12.8	22.3	.3	.6	.7	1.6
Upper Arkansas, White, Red	1.2	4.2	7.0	12.4	.3	.5	1.1	1.9
Western Gulf	2.5	9.0	11.6	23.1	.5	2.8	5.3	8.6
Upper Rio Grande-Pecos	.1	.9	1.0	2.0	.0	.0	.0	.0
Colorado	.0	.1	.3	.4	.0	.0	.0	.0
Great Basin	.0	.0	.2	.2	.0	.0	.0	.0
Pacific Northwest	.0	.3	1.2	1.5	.0	.1	.6	.7
Central Pacific	.1	.6	1.7	2.4	.0	.0	.0	.0
South Pacific	.0	.0	.1	.1	.0	.0	.0	.0
Total	5.3	23.2	35.9	64.4	1.1	4.0	7.7	12.8
United States	10.6	39.0	61.2	110.8	7.9	35.6	64.3	107.8

1/ Estimates compiled in 1948-49 by Soil Conservation Service (includes both privately owned and publicly owned land). Allocation by water resource regions was made by the Agricultural Research Service. Potential shifts apply to physical potential. The full realization of such shifts (particularly to more intensive use) is not necessarily recommended or economically desirable under present conditions.

Table 20.- Land suitable for irrigation if water were available, by water resource regions 1/

Water resource region	Total potential cropland 2/	Potential irrigated area	
		Area in which soils are suitable for irrigation 3/	Area in which soils are suitable and water available 4/
	Mil. acres	Mil. acres	Mil. acres
Eastern:			
New England	5.4	0.4	0.4
Delaware and Hudson	7.8	.9	.9
Chesapeake Bay	13.9	1.9	1.9
Southeast	74.5	8.6	8.6
Eastern Great Lakes	15.0	1.1	1.1
Western Great Lakes	23.2	1.5	1.5
Ohio	45.5	2.5	2.5
Cumberland	4.8	.2	.2
Tennessee	9.9	.4	.4
Upper Mississippi	72.2	6.0	6.0
Lower Mississippi	21.4	3.0	3.0
Lower Missouri	20.1	1.8	1.8
Lower Arkansas, White, Red	31.7	2.9	2.9
Total	345.4	31.2	31.2
Western:			
Upper Missouri	103.1	19.6	12.1
Upper Arkansas, White, Red	43.9	6.3	2.9
Western Gulf	47.7	9.4	9.4
Upper Rio Grande-Pecos	6.4	2.4	1.9
Colorado	2.7	3.5	3.5
Great Basin	3.0	2.4	2.4
Pacific Northwest	18.1	7.9	7.9
Central Pacific	10.8	8.9	8.9
South Pacific	2.1	1.6	1.4
Total	237.8	62.0	50.4
United States	583.2	93.2	81.6

1/ Estimates compiled in 1948-49 by Soil Conservation Service (includes both privately owned and publicly owned land). Allocation by water resource regions was made by the Agricultural Research Service. Potential shifts apply to physical potential. The full realization of such shifts (particularly to more intensive use) is not necessarily recommended or economically desirable under present conditions.

2/ Includes land in capability classes I, II, and III in all regions. Class IV land presently used as cropland is included for all Eastern water resource regions. One-half of the class IV cropland is included for the Western regions.

3/ As estimated by Agricultural Research Service and Soil Conservation Service. Estimates based on suitability of soils for irrigation. Availability of water has not been considered in making these estimates.

4/ Based on a rough preliminary check of water supply. Water supplies assumed to be ample for all suitable soils in Eastern regions. Water supply limits irrigation potential in some Western regions. In addition to the cropland suitable for irrigation, some grazing land is irrigated, especially in the Western regions.

Table 21.- Potential increases in feed production from shifting grassland to cropland, water resource regions, 1980 and 2000

Water resource region	Land not requiring drainage					Land requiring drainage 1/				
	Potential acreage available for conversion	Value of increased output, 1947-49 dollars				Potential acreage available for conversion	Value of increased output, 1947-49 dollars			
		1980		2000			1980		2000	
		Per acre	Total	Per acre	Total		Per acre	Total	Per acre	Total
	Million acres	Dollars	Million dollars	Dollars	Million dollars	Million acres	Dollars	Million dollars	Dollars	Million dollars
Eastern:										
New England	0.5	78	39.0	100	50.0	0.1	78	7.8	100	10.0
Delaware and Hudson	0.1	72	7.2	105	10.5	0.3	72	21.6	105	31.5
Chesapeake Bay	1.5	67	100.5	90	135.0	0.7	67	46.9	90	63.0
Southeast	7.4	43	318.2	54	399.6	1.8	43	77.4	54	97.2
Eastern Great Lakes	1.0	81	81.0	106	106.0	0.7	81	56.7	106	74.2
Western Great Lakes	0.3	61	18.3	79	23.7	0.8	61	48.8	79	63.2
Ohio	5.1	76	387.6	99	504.9	1.1	76	83.6	99	108.9
Cumberland	0.5	54	27.0	72	36.0	0.1	54	5.4	72	7.2
Tennessee	1.0	51	51.0	63	63.0	0.2	51	10.2	63	12.6
Upper Mississippi	6.9	63	434.7	85	586.5	2.3	63	144.9	85	195.5
Lower Mississippi	1.4	60	84.0	81	113.4	0.9	60	54.0	81	72.9
Lower Missouri	2.5	70	175.0	90	225.0	0.4	70	28.0	90	36.0
Lower Arkansas, White, Red	4.9	64	313.6	82	401.8	0.7	64	44.8	82	57.4
Total	33.1	--	2,037.1	--	2,655.4	10.1	--	630.1	--	829.6
Western:										
Upper Missouri	17.8	27	480.6	39	694.2					
Upper Arkansas, White, Red	9.9	36	356.4	48	475.2					
Western Gulf	18.5	36	666.0	48	888.0					
Upper Rio Grande-Pecos	1.6	36	57.6	48	76.8					
Colorado	0.1	30	3.0	37	3.7					
Great Basin	0.2	21	4.2	24	4.8					
Pacific Northwest	1.2	22	26.4	27	32.4					
Central Pacific	1.9	16	30.4	21	39.9					
South Pacific	0.1	16	1.6	21	2.1					
Total	51.3	--	1,626.2	--	2,217.1					
United States	84.4	--	3,663.3	--	4,872.5					

1/ No land requiring drainage was assumed in the Western resource regions.

Table 22.- Potential increases in feed production from shifting forest land to cropland, water resource regions, 1980 and 2000 1/

Water resource region	Land not requiring drainage					Land requiring drainage				
	Potential acreage available for conversion	Value of increased output, 1947-49 dollars				Potential acreage available for conversion	Value of increased output, 1947-49 dollars			
		1980		2000			1980		2000	
		Per acre	Total	Per acre	Total		Per acre	Total	Per acre	Total
	Million acres	Dollars	Million dollars	Dollars	Million dollars	Million acres	Dollars	Million dollars	Dollars	Million dollars
Eastern:										
New England	0.2	90	18.0	114	22.8	0.7	90	63.0	114	79.8
Delaware and Hudson	.1	97	9.7	132	13.2	.7	97	67.9	132	92.4
Chesapeake Bay	0	0	0	0	0	1.8	91	163.8	115	207.0
Southeast	15.2	69	1,048.8	81	1,231.2	13.4	69	924.6	81	1,085.4
Eastern Great Lakes	0	0	0	0	0	.6	102	61.2	129	77.4
Western Great Lakes	1.7	76	129.2	96	163.2	.6	76	45.6	96	57.6
Ohio	4.2	96	403.2	120	504.0	1.6	96	153.6	120	192.0
Cumberland	.6	75	45.0	94	56.4	.2	75	15.0	94	18.8
Tennessee	1.4	72	100.8	85	119.0	.5	72	36.0	85	42.5
Upper Mississippi	2.0	91	182.0	115	230.0	1.2	91	109.2	115	138.0
Lower Mississippi	4.7	85	399.5	108	507.6	1.9	85	161.5	108	205.2
Lower Missouri	.6	88	52.8	109	65.4	.2	88	17.6	109	21.8
Lower Arkansas, White, Red	6.5	76	494.0	96	624.0	1.3	76	98.8	96	124.8
Total	37.2	---	2,883.0	---	3,536.8	24.7	---	1,917.8	---	2,222.6

1/ No forest land was assumed to be available for conversion in the Western water resource regions.

Table 23.- Potential increases in feed production from drainage of existing cropland, water resource regions, 1980 and 2000 1/

Water resource region	Potential acreage available for conversion	Value of increased output, 1947-49 dollars			
		1980		2000	
		Per acre	Total	Per acre	Total
	Million acres	Dollars	Million dollars	Dollars	Million dollars
Eastern:					
New England	0.5	30	15.0	48	24.0
Delaware and Hudson	0.9	37	33.3	66	59.4
Chesapeake Bay	1.6	31	49.6	49	78.4
Southeast	5.3	39	206.7	48	254.4
Eastern Great Lakes	3.5	27	94.5	27	94.5
Western Great Lakes	5.0	13	65.0	27	135.0
Ohio	6.9	31	213.9	49	338.1
Cumberland	0.2	37	7.4	52	10.4
Tennessee	0.7	34	23.8	43	30.1
Upper Mississippi	8.5	24	204.0	40	340.0
Lower Mississippi	4.5	48	216.0	66	297.0
Lower Missouri	2.3	36	82.8	51	117.3
Lower Arkansas, White, Red	2.9	39	113.1	54	156.6
Total	42.8	--	1,325.1	--	1,935.2

1/ No wet cropland assumed in Western water resource regions.

Table 24.- Increase in production under irrigation potential II, water resource regions, 1980 and 2000 1/

Water resource region	1980						2000					
	Crops			Pasture			Crops			Pasture		
	Acreage added by irrigation	Value of increased output, 1947-49 dollars		Acreage added by irrigation	Value of increased output, 1947-49 dollars		Acreage added by irrigation	Value of increased output, 1947-49 dollars		Acreage added by irrigation	Value of increased output, 1947-49 dollars	
		Per acre	Total		Per acre	Total		Per acre	Total		Per acre	Total
	Thous. acres	Dollars	Thous. dollars	Thous. acres	Dollars	Thous. dollars	Thous. acres	Dollars	Thous. dollars	Thous. acres	Dollars	Thous. dollars
Eastern:												
New England	65	757	49,200	3	11	33	70	764	53,500	3	14	42
Delaware and Hudson	107	534	57,100	4	21	84	110	535	58,800	4	27	108
Chesapeake Bay	65	479	31,100	15	20	300	85	503	42,800	20	29	580
Southeast	553	569	314,700	228	15	3,420	357	675	241,000	147	19	2,793
Eastern Great Lakes	25	499	12,500	1	10	10	27	546	14,700	1	13	13
Western Great Lakes	91	378	34,400	3	10	30	124	457	56,700	4	12	48
Ohio	111	268	29,700	15	17	255	151	363	54,800	21	22	462
Cumberland	0	233	0	0	18	0	0	333	0	0	24	0
Tennessee	0	301	0	0	20	0	1	375	400	0	27	0
Upper Mississippi	145	411	59,600	4	22	88	199	436	86,800	6	28	168
Lower Mississippi	132	125	16,500	3	16	48	3	167	500	0	20	0
Lower Missouri	22	77	1,700	2	19	38	30	108	3,200	3	24	72
Lower, Arkansas, White, Red	0	73	0	0	21	0	49	145	7,100	0	27	0
Total	1,316	---	606,500	278	---	4,306	1,206	---	620,300	209	---	4,286
Western:												
Upper Missouri	2,180	54	117,700	462	23	10,626	1,817	54	98,100	385	29	11,165
Upper Arkansas, White, Red	173	123	21,300	18	30	540	217	162	35,200	23	40	920
Western Gulf	398	179	71,200	16	27	432	869	228	198,100	32	34	1,088
Upper Rio Grande-Pecos	54	154	8,300	7	38	266	0	152	0	0	44	0
Colorado	0	161	0	0	16	0	0	191	0	0	17	0
Great Basin	34	30	1,000	16	13	208	0	29	0	0	14	0
Pacific Northwest	645	89	57,400	199	32	6,368	1,465	95	139,200	451	39	17,589
Central Pacific	126	148	18,600	26	41	1,066	74	149	11,000	15	49	735
South Pacific	19	311	5,900	3	48	144	8	322	2,600	1	58	58
Total	3,629	---	301,400	747	---	19,650	4,450	---	484,200	907	---	31,555
United States	4,945	---	907,900	1,025	---	23,956	5,656	---	1,104,500	1,116	---	35,841

1/ See table 11 for total acreage assumed for irrigation potential II. The acreages in this table are additional to acreages assumed for irrigation potential I, after deductions for projected losses to special uses.

Table 25.- Value of production from irrigation of feed crops on acreage added under irrigation potential III over that irrigated under potential II, by water resource regions, 1980 and 2000 1/

Water resource region	1980			2000		
	Increased acreage	Value of increased output in 1947-49 dollars		Increased acreage	Value of increased output in 1947-49 dollars	
		Per acre	Total		Per acre	Total
	Thousand acres	Dollars	Million dollars	Thousand acres	Dollars	Million dollars
Eastern:						
New England	319	22	7.0	269	22	5.9
Delaware and Hudson	557	30	16.7	416	37	15.4
Chesapeake Bay	1,788	36	64.4	1,721	45	77.4
Southeast	6,968	36	250.8	6,620	42	278.0
Eastern Great Lakes	997	33	32.9	967	42	40.6
Western Great Lakes	1,342	28	37.6	1,275	36	45.9
Ohio	2,291	36	82.5	2,203	46	101.3
Cumberland	160	22	3.5	155	28	4.3
Tennessee	410	25	10.2	384	30	11.5
Upper Mississippi	5,829	43	250.6	5,731	54	309.5
Lower Mississippi	1,952	34	66.4	1,445	45	65.0
Lower Missouri	1,780	39	69.4	1,762	49	86.3
Lower Arkansas, White, Red	1,897	28	53.1	1,137	34	38.6
Total	26,290	---	945.0	24,085	---	1,079.7
Western:						
Upper Missouri	3,968	68	269.8	2,336	90	210.2
Upper Arkansas, White, Red	1,079	75	80.9	700	96	67.2
Western Gulf	3,883	67	260.2	2,329	85	198.0
Upper Rio Grande-Pecos	403	72	29.0	219	90	19.7
Colorado	200	103	20.6	0	129	0
Great Basin	100	73	7.3	0	87	0
Pacific Northwest	2,016	78	157.2	190	100	19.0
Central Pacific	1,543	91	140.4	989	117	115.7
South Pacific	500	91	45.5	454	117	53.1
Total	13,692	---	1,010.9	7,217	---	682.9
United States	39,982	---	1,956.0	31,302	---	1,762.6

1/ Irrigation potential III is based on suitability of land for irrigation as indicated by land capability classifications of the Soil Conservation Service.

Table 26.- Potential increases in feed production from shifting of cropland to grass, water resoure regions, 1980 and 2000

Water resource region	Potential acreage available for conversion 1/	Value of increased output, 1947-49 dollars			
		1980		2000	
		Per acre	Total	Per acre	Total
	Million acres	Dollars	Million dollars	Dollars	Million dollars
Eastern:					
New England	0.2	15	3.0	14	2.8
Delaware and Hudson	.4	29	11.6	25	10.0
Chesapeake Bay	.7	23	16.1	23	16.1
Southeast	3.1	24	74.4	6	18.6
Eastern Great Lakes	.6	18	10.8	25	15.0
Western Great Lakes	2.6	24	62.4	25	65.0
Ohio	2.7	26	70.2	25	67.5
Cumberland	.4	23	9.2	21	8.4
Tennessee	.8	25	20.0	24	19.2
Upper Mississippi	.7	5	3.5	7	4.9
Lower Mississippi	4.3	14	60.2	10	43.0
Lower Missouri	1.3	10	13.0	12	15.6
Lower Arkansas, White, Red	1.9	5	9.5	10	19.0
Total	19.7	--	363.9	--	305.1
Western:					
Upper Missouri	16.5	5	82.5	2	33.0
Upper Arkansas, White, Red	7.2	5	36.0	4	28.8
Western Gulf	4.1	10	41.0	7	28.7
Upper Rio Grande-Pecos	1.1	5	5.5	6	6.6
Colorado	.3	6	1.8	7	2.1
Great Basin	0	0	0	0	0
Pacific Northwest	.5	6	3.0	7	3.5
Central Pacific	.2	2	.4	5	1.0
South Pacific	.1	2	.2	5	.5
Total	30.0	--	170.4	--	104.2
United States	49.7	--	534.3	--	409.3

1/ Includes cropland in capability classes V, VI, and VII not considered suitable for regular cultivation in all regions and part of the class IV cropland in some Western water resource regions.

Table 27.- Potential increases in feed production from shifting forest land to pasture, water resource regions, 1980 and 2000 1/

Water resource region	Potential acreage available for conversion	Value of increased output, 1947-49 dollars			
		1980		2000	
		Per acre	Total	Per acre	Total
	Million acres	Dollars	Million dollars	Dollars	Million dollars
Eastern:					
New England	1.0	46	46.0	54	54.0
Delaware and Hudson	.3	63	18.9	72	21.6
Chesapeake Bay	.6	55	33.0	63	37.8
Southeast	2.8	48	134.4	52	145.6
Eastern Great Lakes	.3	54	16.2	61	18.3
Western Great Lakes	.4	51	20.4	58	23.2
Ohio	1.8	60	108.0	67	120.6
Cumberland	.2	49	9.8	54	10.8
Tennessee	.4	49	19.6	54	21.6
Upper Mississippi	1.0	64	64.0	73	73.0
Lower Mississippi	1.1	52	57.2	60	66.0
Lower Missouri	.1	57	5.7	64	6.4
Lower Arkansas, White, Red	1.4	31	43.4	32	44.8
Total	11.4	--	576.6	--	643.7

1/ No forest land was assumed to be available for conversion in the Western water resource regions.

Table 28.- Potential increases in feed production from pasture and rangeland improvement, water resource regions, 1980 and 2000

Water resource region	Improved acreage 1/	Value of increased output, 1947-49 dollars			
		1980		2000	
		Per acre	Total	Per acre	Total
	Million acres	Dollars	Million Dollars	Dollars	Million Dollars
Eastern:					
New England	0.2	34	6.8	40	8.0
Delaware and Hudson	.8	37	29.6	45	36.0
Chesapeake Bay	1.1	31	34.1	37	40.7
Southeast	2.7	22	59.4	25	67.5
Eastern Great Lakes	.7	33	23.1	39	27.3
Western Great Lakes	.2	36	7.2	42	8.4
Ohio	1.8	40	72.0	46	82.8
Cumberland	.1	28	2.8	31	3.1
Tennessee	.7	18	12.6	19	13.3
Upper Mississippi	.4	36	14.4	43	17.2
Lower Mississippi	.2	27	5.4	33	6.6
Lower Missouri	2.8	39	109.2	45	126.0
Lower Arkansas, White, Red	2.9	19	55.1	25	72.5
Total	14.6	--	431.7	--	509.4
Western:					
Upper Missouri	21.1	14	295.4	20	422.0
Upper Arkansas, White, Red	6.8	15	102.0	21	142.8
Western Gulf	13.3	11	146.3	15	199.5
Upper Rio Grande-Pecos	3.1	17	52.7	23	71.3
Colorado	1.3	14	18.2	16	20.8
Great Basin	1.2	11	13.2	12	14.4
Pacific Northwest	4.7	22	103.4	31	145.7
Central Pacific	4.3	23	98.9	33	141.9
South Pacific	.4	23	9.2	33	13.2
Total	56.2	--	839.3	--	1,171.6
United States	70.8	--	1,271.0	--	1,681.0

1/ This is land in capability classes I-IV in the Western water resource regions and class IV land in the Eastern regions that has not been shifted to cropland. Includes grassland in capability class V in all regions and a small amount of land in class VI in Eastern water resource regions.

Table 29.- Major uses of land, by water resource regions, 1954

Water resource region	Cropland 1/		Open pasture and grazing land 2/		Woodland and forest 3/		Other land 4/		Total land area	
	Total	Percentage of total land area	Total	Percentage of total land area	Total	Percentage of total land area	Total	Percentage of total land area	Total	Percentage of total land area
	Thous. acres	Percent	Thous. acres	Percent	Thous. acres	Percent	Thous. acres	Percent	Thous. acres	Percent
Eastern:										
New England	3,069	8	793	2	29,658	80	3,779	10	37,299	100
Delaware and Hudson	5,033	22	1,304	6	11,422	51	4,649	21	22,408	100
Chesapeake Bay	9,842	24	3,629	9	23,112	57	4,267	10	40,850	100
Southeast	33,723	20	12,915	8	108,626	64	13,536	8	168,800	100
Eastern Great Lakes	12,079	40	2,502	8	9,755	32	5,963	20	30,299	100
Western Great Lakes	16,309	29	1,431	2	31,427	56	7,561	13	56,728	100
Ohio	36,704	40	8,794	10	33,238	36	12,297	14	91,033	100
Cumberland	3,723	33	676	6	5,855	52	943	9	11,197	100
Tennessee	6,910	26	2,211	8	15,097	56	2,705	10	26,923	100
Upper Mississippi	65,459	57	9,889	8	25,427	22	14,941	13	115,716	100
Lower Mississippi	13,812	36	3,194	8	16,093	42	5,585	14	38,684	100
Lower Missouri	17,557	52	6,513	19	6,593	19	3,526	10	34,189	100
Lower Arkansas, White, Red	16,437	23	10,776	15	38,339	55	4,976	7	70,528	100
Total	240,657	32	64,627	9	354,642	48	84,728	11	744,654	100
Western:										
Upper Missouri	110,919	34	170,768	53	30,471	9	10,846	4	323,004	100
Upper Arkansas, White, Red	37,367	34	55,918	51	10,705	10	5,140	5	109,130	100
Western Gulf	29,652	25	51,200	42	26,487	22	13,762	11	121,101	100
Upper Rio Grande-Pecos	2,676	3	58,527	66	19,311	22	7,684	9	88,198	100
Colorado	3,954	3	84,243	54	44,237	28	23,290	15	155,724	100
Great Basin	3,341	3	63,617	57	24,812	22	20,005	18	111,775	100
Pacific Northwest	18,099	12	47,640	30	84,115	53	7,849	5	157,703	100
Central Pacific	11,205	17	9,096	14	37,865	57	8,115	12	66,281	100
South Pacific	1,779	7	5,825	22	5,867	22	12,784	49	26,255	100
Total	218,992	19	546,834	47	283,870	25	109,475	9	1,159,171	100
United States	459,649	24	611,461	32	638,512	34	194,203	10	1,903,825	100

1/ Cropland harvested, crop failure, cultivated summer fallow, cropland used only for pasture, and other cropland not harvested or pastured, including soil improvement crops, newly planted crops and idle cropland, as reported by the U. S. Census of Agriculture in 1954. The total acreage of cropland harvested reported by the U. S. Department of Agriculture in 1954 was 5 million acres greater than the acreage included here.

2/ Open permanent pasture in farms and open grazing land not in farms, including grassland and other nonforest grazing land. From the U. S. Census of Agriculture and U. S. Department of Agriculture estimates in 1954, with the exception of adjustments in the Pacific Northwest and Central Pacific Regions, and in U. S. totals, to conform to the total forest estimate as cited in footnote 3.

3/ All land classified as forest land in the United States (excluding Alaska and Hawaii). 1959 estimates by the Forest Service, USDA.

4/ Land in urban areas, and rural areas in highway, road and railway rights-of-way, airports, reservoirs, flood-control areas, parks, wildlife refuges, national defense sites, public institutions, and all other land unaccounted for, except forested lands in parks, wildlife refuges and other public special use areas which are included in the total forest area.

Table 30.- Sources of additional land required for special uses at projected population levels for 1980 and 2000, by water resource regions 1/

Water resource region	At projected low population levels									
	Sources of additional land required in 1980					Sources of additional land required in 2000				
	Cropland	Pasture	Forest	Other	Total	Cropland	Pasture	Forest	Other	Total
	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres
Eastern:										
New England	64	16	640	80	800	88	22	880	110	1,100
Delaware and Hudson	572	156	1,326	546	2,600	1,012	276	2,346	966	4,600
Chesapeake Bay	480	180	1,140	200	2,000	816	306	1,938	340	3,400
Southeast	640	256	2,048	256	3,200	1,120	448	3,584	448	5,600
Eastern Great Lakes	720	144	576	360	1,800	1,480	296	1,184	740	3,700
Western Great Lakes	725	75	1,375	325	2,500	1,247	129	2,365	559	4,300
Ohio	1,240	310	1,116	434	3,100	2,000	500	1,800	700	5,000
Cumberland	33	6	52	9	100	33	6	52	9	100
Tennessee	52	16	112	20	200	52	16	112	20	200
Upper Mississippi	912	128	352	208	1,600	1,368	192	528	312	2,400
Lower Mississippi	72	16	84	28	200	72	16	84	28	200
Lower Missouri	52	19	19	10	100	0	0	0	0	0
Lower Arkansas, White, Red	0	0	0	0	0	0	0	0	0	0
Total	5,562	1,322	8,840	2,476	18,200	9,288	2,207	14,873	4,232	30,600
Western:										
Upper Missouri	136	212	40	12	400	204	318	60	18	600
Upper Arkansas, White, Red	136	204	40	20	400	170	255	50	25	500
Western Gulf	475	798	418	209	1,900	800	1,344	704	352	3,200
Upper Rio Grande-Pecos	6	132	44	18	200	18	396	132	54	600
Colorado	18	324	168	90	600	33	594	308	165	1,100
Great Basin	12	228	88	72	400	21	399	154	126	700
Pacific Northwest	144	360	636	60	1,200	288	720	1,272	120	2,400
Central Pacific	493	406	1,653	348	2,900	969	798	3,249	684	5,700
South Pacific	203	638	638	1,421	2,900	378	1,188	1,188	2,646	5,400
Total	1,623	3,302	3,725	2,250	10,900	2,881	6,012	7,117	4,190	20,200
United States	7,185	4,624	12,565	4,726	29,100	12,169	8,219	21,990	8,422	50,800

See footnote at end of table.

—Continued

Table 30.- Sources of additional land required for special uses at projected population levels for 1980 and 2000, by water resource regions 1/ - continued

Water resource region	At projected medium population levels									
	Sources of additional land required in 1980					Sources of additional land required in 2000				
	Cropland	Pasture	Forest	Other	Total	Cropland	Pasture	Forest	Other	Total
	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres
Eastern:										
New England	96	24	960	120	1,200	192	48	1,920	240	2,400
Delaware and Hudson	924	252	2,142	882	4,200	1,804	492	4,182	1,722	8,200
Chesapeake Bay	600	225	1,425	250	2,500	1,296	486	3,078	540	5,400
Southeast	840	336	2,688	336	4,200	1,800	720	5,760	720	9,000
Eastern Great Lakes	1,040	208	832	520	2,600	2,400	480	1,920	1,200	6,000
Western Great Lakes	1,102	114	2,090	494	3,800	1,972	204	3,740	884	6,800
Ohio	1,640	410	1,476	574	4,100	3,280	820	2,952	1,148	8,200
Cumberland	66	12	104	18	200	66	12	104	18	200
Tennessee	78	24	168	30	300	156	48	336	60	600
Upper Mississippi	1,254	176	484	286	2,200	2,451	344	946	559	4,300
Lower Mississippi	144	32	168	56	400	288	64	336	112	800
Lower Missouri	104	38	38	20	200	156	57	57	30	300
Lower Arkansas, White, Red	0	0	0	0	0	0	0	0	0	0
Total	7,888	1,851	12,575	3,586	25,900	15,861	3,775	25,331	7,233	52,200
Western:										
Upper Missouri	238	371	70	21	700	442	689	130	39	1,300
Upper Arkansas, White, Red	204	306	60	30	600	340	510	100	50	1,000
Western Gulf	600	1,000	528	264	2,400	1,225	2,058	1,076	539	4,900
Upper Rio Grande-Pecos	12	264	88	36	400	24	528	176	72	800
Colorado	24	432	224	120	800	45	810	420	225	1,500
Great Basin	12	228	88	72	400	30	570	220	180	1,000
Pacific Northwest	192	480	848	80	1,600	432	1,080	1,908	180	3,600
Central Pacific	578	476	1,938	408	3,400	1,326	1,092	4,446	936	7,800
South Pacific	238	748	748	1,666	3,400	518	1,628	1,628	3,626	7,400
Total	2,098	4,313	4,592	2,697	13,700	4,382	8,965	10,106	5,847	29,300
United States	9,986	6,164	17,167	6,283	39,600	20,243	12,740	35,437	13,080	81,500

See footnote at end of table.

-Continued

Table 30.- Sources of additional land required for special uses at projected population levels for 1980 and 2000, by water resource regions 1/ - continued

Water resource region	At projected high population levels									
	Sources of additional land required in 1980					Sources of additional land required in 2000				
	Cropland	Pasture	Forest	Other	Total	Cropland	Pasture	Forest	Other	Total
	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres
Eastern:										
New England	160	40	1,600	200	2,000	368	92	3,680	460	4,600
Delaware and Hudson	1,364	372	3,162	1,302	6,200	3,124	852	7,242	2,982	14,200
Chesapeake Bay	864	324	2,052	360	3,600	2,064	774	4,902	860	8,600
Southeast	1,200	480	3,840	480	6,000	2,920	1,168	9,344	1,168	14,600
Eastern Great Lakes	1,520	304	1,216	760	3,800	3,920	784	3,136	1,960	9,800
Western Great Lakes	1,334	138	2,530	598	4,600	3,132	324	5,940	1,404	10,800
Ohio	2,360	590	2,124	826	5,900	5,360	1,340	4,824	1,876	13,400
Cumberland	66	12	104	18	200	198	36	312	54	600
Tennessee	156	48	336	60	600	312	96	672	120	1,200
Upper Mississippi	1,938	272	748	442	3,400	4,218	592	1,628	962	7,400
Lower Mississippi	288	64	336	112	800	612	136	714	238	1,700
Lower Missouri	208	76	76	40	400	364	133	133	70	700
Lower Arkansas, White, Red	0	0	0	0	0	0	0	0	0	0
Total	11,458	2,720	18,124	5,198	37,500	26,592	6,327	42,527	12,154	87,600
Western:										
Upper Missouri	408	636	120	36	1,200	884	1,378	260	78	2,600
Upper Arkansas, White, Red	272	408	80	40	800	612	918	180	90	1,800
Western Gulf	800	1,344	704	352	3,200	1,900	3,192	1,672	836	7,600
Upper Rio Grande-Pecos	12	264	88	36	400	36	792	264	108	1,200
Colorado	27	486	252	135	900	66	1,188	616	330	2,200
Great Basin	18	342	132	108	600	42	798	308	252	1,400
Pacific Northwest	252	630	1,113	105	2,100	660	1,650	2,915	275	5,500
Central Pacific	731	602	2,451	516	4,300	1,870	1,540	6,270	1,320	11,000
South Pacific	308	968	968	2,156	4,400	756	2,376	2,376	5,292	10,800
Total	2,828	5,680	5,908	3,484	17,900	6,826	13,832	14,861	8,581	44,100
United States	14,286	8,400	24,032	8,682	55,400	33,418	20,159	57,388	20,735	131,700

1/ Includes urban areas, and rural areas in highway, road and railway rights-of-way, airports, reservoirs, flood-control areas, parks, wildlife refuges, national defense sites, and public institutions. Estimates were based on acreages per family and per capita now in such uses; recent trends, especially 1945 to 1959; and the analyses of Bartholomew, Clawson, and others who have recently investigated urbanization and its impacts on land use. It is estimated that approximately 0.5 to 0.7 acre per capita of the total population is required for special land uses. While there are some differences between regions in acreages per capita in special use areas, in the time available these differences could not be estimated accurately enough for reliable use in projections. This table represents a straight line projection of 0.5 acre additional land requirement per capita for the projected increases in population for the three levels of low, medium, and high. The projected total additional land requirement was distributed among the major uses of cropland, pasture, forest land, and other land in the same ratio as existed in 1954.

Thus, the figures used are rough approximations indicative of magnitude, rather than exact estimates of the sources of the land. For instance, estimates of cropland conversions may be low and those of forest land high. Forest land may be drawn upon to an increasing extent for recreational use as well as for urban uses in certain regions. For example, major population increase and urban expansion are indicated in the Northeastern, Lake, and Pacific Regions, where there are large forest acreages and comparatively moderate acreages of cropland in proportion to the total land area.

Table 31.- Land in special uses in 1954, and projections for low, medium, and high population levels in 1980 and 2000, by water resource regions 1/

Water resource region	1954	1980			2000		
		Low	Medium	High	Low	Medium	High
	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres
Eastern:							
New England	2,253	3,053	3,453	4,253	3,353	4,653	6,853
Delaware and Hudson	4,000	6,600	8,200	10,200	8,600	12,000	18,200
Chesapeake Bay	3,400	5,400	5,900	7,000	6,800	8,600	12,000
Southeast	11,139	14,339	15,339	17,139	16,739	20,139	25,739
Eastern Great Lakes	3,000	4,800	5,600	10,144	6,700	9,000	12,800
Western Great Lakes	4,328	6,828	8,128	8,928	8,628	11,128	15,128
Ohio	6,344	9,444	10,444	12,244	11,344	14,544	19,744
Cumberland	731	831	931	931	831	931	1,331
Tennessee	1,767	1,967	2,067	2,967	1,967	2,367	2,967
Upper Mississippi	7,821	9,421	10,021	11,221	10,221	12,121	15,221
Lower Mississippi	1,780	1,980	2,180	2,580	1,980	2,580	3,480
Lower Missouri	1,908	2,008	2,108	2,308	1,908	2,208	2,608
Lower Arkansas, White, Red	3,137	3,037	3,137	3,137	2,737	3,137	3,137
Total	51,608	69,708	77,508	93,052	81,808	103,408	139,208
Western:							
Upper Missouri	12,000	12,400	12,700	13,200	12,600	13,300	14,600
Upper Arkansas, White, Red	4,200	4,600	4,800	5,000	4,700	5,200	6,000
Western Gulf	4,200	6,100	6,600	7,400	7,400	9,100	11,800
Upper Rio Grande-Pecos	3,000	3,200	3,400	3,400	3,600	3,800	4,200
Colorado	9,404	10,004	10,204	10,304	10,504	10,904	11,604
Great Basin	7,497	7,897	7,897	8,097	8,197	8,497	8,897
Pacific Northwest	7,049	8,249	8,649	9,149	9,449	10,649	12,549
Central Pacific	7,915	10,815	11,315	12,215	13,600	15,715	18,915
South Pacific	3,353	6,253	6,753	7,753	6,253	10,753	14,153
Total	58,618	69,518	72,318	76,518	76,303	87,918	102,718
United States	110,226	139,226	149,826	169,570	158,111	191,326	241,926

1/ Includes urban areas, and rural areas in highway, road and railway rights-of-way, airports, reservoirs, flood-control areas, parks, wildlife refuges, national defense sites, and public institutions. Estimates were based on acreages per family and per capita now in such uses; recent trends, especially 1945 to 1959; and the analyses of Bartholomew, Clawson, and others who have recently investigated urbanization and its impacts on land use. It is estimated that approximately 0.5 to 0.7 acre per capita of the total population is required for special land uses. While there are some differences between regions in acreages per capita in special use areas, in the time available these differences could not be estimated accurately enough for reliable use in projections. This table represents a straight line projection of 0.5 acre additional land requirement per capita for the projected increases in population for the three levels of low, medium, and high. The projected total additional land requirement was distributed among the major uses of cropland, pasture, forest land, and other land in the same ratio as existed in 1954.

Thus, the figures used are rough approximations indicative of magnitude, rather than exact estimates of the sources of the land. For instance, estimates of cropland conversions may be low and those of forest land high. Forest land may be drawn upon to an increasing extent for recreational use as well as for urban uses in certain regions. For example, major population increase and urban expansion are indicated in the Northeastern, Lake, and Pacific Regions, where there are large forest acreages and comparatively moderate acreages of cropland in proportion to the total land area.

Table 32.- Cropland acreage, 1954, and cropland in 1980 and 2000 after deductions for absorption by nonfarm uses and retirement of areas unsuited to cultivation 1/

Water resource region	Cropland acreage						
	1954	1980			2000		
		Low	Medium	High	Low	Medium	High
	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres
Eastern:							
New England	3,069	2,805	2,773	2,709	2,781	2,677	2,501
Delaware and Hudson	5,033	4,061	3,709	3,269	3,621	2,829	1,509
Chesapeake Bay	9,842	8,662	8,542	8,278	8,326	7,846	7,078
Southeast	33,723	29,983	29,783	29,423	29,503	28,823	27,703
Eastern Great Lakes	12,079	10,759	10,439	9,959	9,999	9,079	7,559
Western Great Lakes	16,309	12,984	12,607	12,375	12,462	11,737	10,577
Ohio	36,704	32,764	32,364	31,644	32,004	30,724	28,644
Cumberland	3,723	3,290	3,257	3,257	3,290	3,257	3,125
Tennessee	6,910	6,058	6,032	5,954	6,058	5,954	5,798
Upper Mississippi	65,459	63,847	63,505	62,821	63,391	62,308	60,541
Lower Mississippi	13,812	9,440	9,368	9,224	9,440	9,224	8,900
Lower Missouri	17,557	16,205	16,153	16,049	16,257	16,101	15,893
Lower Arkansas, White, Red	16,437	14,560	14,537	14,537	14,629	14,537	14,537
Total	240,657	215,418	213,069	209,499	211,761	205,096	194,365
Western:							
Upper Missouri	110,919	94,283	94,181	94,011	94,215	93,977	93,535
Upper Arkansas, White, Red	37,367	30,031	29,963	29,895	29,997	29,827	29,555
Western Gulf	29,652	25,077	24,952	24,752	24,752	24,327	23,652
Upper Rio Grande-Pecos	2,676	1,570	1,564	1,564	1,558	1,552	1,540
Colorado	3,954	3,636	3,630	3,627	3,621	3,609	3,588
Great Basin	3,341	3,329	3,329	3,323	3,320	3,311	3,299
Pacific Northwest	18,099	17,455	17,407	17,347	17,311	17,167	16,939
Central Pacific	11,205	10,512	10,427	10,274	10,036	9,679	9,135
South Pacific	1,779	1,476	1,441	1,371	1,301	1,161	923
Total	218,992	187,369	186,894	186,164	186,111	184,610	182,166
United States	459,649	402,787	399,963	395,663	397,872	389,706	376,531

1/ Projected cropland after subtraction of (1) estimated losses to urban and other nonfarm uses to provide living and working space for the larger populations projected for 1980 and 2000; and (2) acreages of steep, erodible, and other acres unsuited to cultivation which are recommended for conversion to grass. Total cropland includes cropland harvested, crop failure, fallow, soil improvement crops, and cropland used for pasture.

Table 33.- Acreage of grassland pasture and grazing land in 1954, and projections for 1980 and 2000 after projected shifts from 1954 acreage to nonfarm and cropland uses, by water resource regions 1/

Water resource region	1954	1980			2000		
		Low	Medium	High	Low	Medium	High
	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres	Thous. acres
Eastern:							
New England	793	177	169	153	171	145	101
Delaware and Hudson	1,304	748	652	532	628	412	52
Chesapeake Bay	3,629	1,249	1,204	1,105	1,123	943	655
Southeast	12,915	3,459	3,379	3,235	3,267	2,995	2,547
Eastern Great Lakes	2,502	658	594	498	506	322	18
Western Great Lakes	1,431	256	217	193	202	127	7
Ohio	8,794	2,284	2,184	2,004	2,094	1,774	1,254
Cumberland	676	70	64	64	70	64	40
Tennessee	2,211	995	987	963	995	963	915
Upper Mississippi	9,889	561	513	417	497	345	97
Lower Mississippi	3,194	878	862	830	878	830	758
Lower Missouri	6,513	3,594	3,575	3,537	3,563	3,556	3,480
Lower Arkansas, White, Red	10,776	5,176	5,176	5,176	5,176	5,176	5,176
Total	64,627	20,105	19,576	18,707	19,170	17,652	15,100
Western:							
Upper Missouri	170,768	152,756	152,597	152,332	152,650	152,279	151,590
Upper Arkansas, White, Red	55,918	45,814	45,712	45,610	45,763	45,508	45,100
Western Gulf	51,200	31,902	31,692	31,356	31,356	30,642	29,508
Upper Rio Grande-Pecos	58,527	56,795	56,663	56,663	56,531	56,399	56,135
Colorado	84,243	83,819	83,711	83,657	83,549	83,333	82,955
Great Basin	63,617	63,189	63,189	63,075	62,018	62,847	62,619
Pacific Northwest	47,640	46,080	45,960	45,810	45,720	45,360	44,790
Central Pacific	9,096	6,790	6,720	6,594	6,398	6,104	5,656
South Pacific	5,825	5,087	4,977	4,757	4,537	4,097	3,349
Total	546,834	492,232	491,221	489,854	488,522	486,569	481,702
United States	611,461	512,337	510,797	508,561	507,692	504,221	496,802

1/ Obtained by subtracting from 1954 totals the acreages projected for conversion to special uses and to cropland. The grassland acreages in this table do not include cropland pasture, which is reported in total cropland acreage, or woodland pasture, which is included in total forest acreage.

Table 34.- Value of crop production on projected acreage of cropland harvested without land development, conversions from pasture, or new irrigation, by water resource regions, 1980 and 2000 1/

Water resource region	Value of production in 1947-49 dollars					
	1980			2000		
	Low	Medium	High	Low	Medium	High
	Thousand dollars	Thousand dollars	Thousand dollars	Thousand dollars	Thousand dollars	Thousand dollars
Eastern:						
New England	236,778	234,098	228,738	276,816	266,388	249,008
Delaware and Hudson	387,645	354,105	312,051	402,000	313,950	167,550
Chesapeake Bay	544,850	537,285	520,710	616,100	580,600	523,800
Southeast	3,119,364	3,098,556	3,061,224	3,972,276	3,880,800	3,729,924
Eastern Great Lakes	790,500	766,971	731,724	853,092	774,576	644,976
Western Great Lakes	701,384	681,017	668,534	765,426	720,855	649,641
Ohio	1,921,595	1,898,135	1,855,890	2,296,632	2,204,800	2,055,456
Cumberland	136,048	134,728	134,728	165,422	163,817	157,183
Tennessee	288,148	286,918	283,146	354,914	348,753	339,663
Upper Mississippi	4,063,192	4,041,436	3,997,924	5,009,952	4,929,8[illegible]	4,789,980
Lower Mississippi	1,264,466	1,254,692	1,235,506	1,676,640	1,638,240	1,580,640
Lower Missouri	632,000	629,950	625,900	773,480	766,099	756,217
Lower Arkansas, White, Red	591,150	590,170	590,170	789,012	784,083	784,083
Total	14,677,120	14,508,061	14,246,245	17,951,762	17,372,781	16,428,121
Western:						
Upper Missouri	2,722,890	2,719,964	2,715,062	3,222,135	3,213,990	3,198,915
Upper Arkansas, White, Red	1,123,155	1,120,625	1,118,095	1,529,850	1,521,150	1,507,275
Western Gulf	1,837,161	1,827,948	1,813,296	2,515,744	2,472,624	2,403,940
Upper Rio Grande-Pecos	122,400	121,950	121,950	141,750	141,225	140,175
Colorado	474,624	473,856	473,472	566,260	564,420	561,200
Great Basin	115,767	115,767	115,539	129,600	129,280	128,768
Pacific Northwest	1,064,800	1,061,800	1,058,200	1,214,400	1,204,280	1,188,295
Central Pacific	1,344,469	1,333,507	1,314,019	1,485,905	1,433,030	1,352,425
South Pacific	350,445	342,019	325,550	355,080	316,800	251,680
Total	9,155,711	9,117,436	9,055,183	11,160,724	10,996,799	10,732,673
United States	23,832,831	23,625,497	23,301,428	29,112,486	28,369,580	27,160,794

1/ Value of crop production from acreage of cropland harvested is based on projected crop yield increases by 1980 and 2000, on the 1954 acreage after deductions for special uses and retirement.

Table 35.- Value of pasture production on projected acreage of pasture and grazing land without land development, conversions from cropland, or new irrigation, by water resource regions, 1980 and 2000

Water resource region	Value of production in 1947-49 dollars 1/					
	1980			2000		
	Low	Medium	High	Low	Medium	High
	Thousand dollars	Thousand dollars	Thousand dollars	Thousand dollars	Thousand dollars	Thousand dollars
Eastern:						
New England	18,520	16,796	14,386	23,328	18,686	13,770
Delaware and Hudson	22,955	18,243	13,388	25,761	17,461	11,980
Chesapeak Bay	49,590	42,004	21,826	64,310	43,325	24,560
Southeast	182,039	156,764	125,559	221,715	157,509	139,761
Eastern Great Lakes	34,734	29,938	15,921	41,951	29,669	11,736
Western Great Lakes	51,509	46,570	31,717	63,822	38,680	28,669
Ohio	147,549	120,043	80,265	186,717	123,683	87,839
Cumberland	23,456	21,696	20,036	31,733	28,254	25,489
Tennessee	53,216	50,250	31,465	71,307	64,281	39,770
Upper Mississippi	184,747	123,540	56,351	230,165	103,075	60,955
Lower Mississippi	53,393	50,274	35,737	67,906	60,302	43,461
Lower Missouri	96,586	89,233	52,427	122,531	87,562	65,040
Lower Arkansas, White, Red	119,630	97,786	82,025	149,834	106,912	102,343
Total	1,037,924	863,137	581,103	1,301,080	879,399	655,373
Western:						
Upper Missouri	386,105	372,749	359,160	478,099	456,448	442,946
Upper Arkansas, White, Red	169,078	155,001	143,694	200,637	180,104	168,826
Western Gulf	239,286	214,483	185,458	283,618	243,061	211,974
Upper Rio Grande-Pecos	96,500	94,359	93,730	124,705	121,655	120,588
Colorado	88,482	87,584	87,509	137,486	135,912	135,317
Great Basin	46,300	46,266	46,154	54,285	54,095	53,887
Pacific Northwest	109,317	107,992	107,209	136,057	133,520	131,913
Central Pacific	71,296	67,988	65,527	90,703	83,315	77,346
South Pacific	12,972	12,610	10,094	14,785	13,112	7,992
Total	1,219,336	1,159,032	1,098,535	1,520,375	1,421,222	1,350,389
United States	2,257,260	2,022,169	1,679,638	2,821,455	2,300,621	2,005,762

1/ The value of production from pasture and grazing land represents rough approximations of the value of feed units that could be obtained with projected yields from pasture and grazing land acreages after subtraction of grassland acreages required for cropland and special uses and before conversion of cropland and forest land to pasture.

Table 36.- Projections of major uses of land at low population levels, by water resource regions, 1980 and 2000 1/

Water resource region	Cropland		Grassland pasture		Forest		Other		Total area	
	1980	2000	1980	2000	1980	2000	1980	2000	1980	2000
	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres
Eastern:										
New England	3	3	1	1	29	29	4	4	37	37
Delaware and Hudson	4	4	1	1	10	9	7	8	22	22
Chesapeake Bay	10	9	3	3	22	21	6	8	41	41
Southeast	33	33	9	9	103	102	24	25	169	169
Eastern Great Lakes	12	10	2	1	9	9	7	10	30	30
Western Great Lakes	16	15	3	3	30	29	8	10	57	57
Ohio	37	35	9	9	32	31	13	16	91	91
Cumberland	3.5	3.5	1	1	5.5	5.5	1	1	11	11
Tennessee	6	6	2	2	15	15	4	4	27	27
Upper Mississippi	63	60	5	5	25	24	23	27	116	116
Lower Mississippi	14	14	6	6	15	15	4	4	39	39
Lower Missouri	17	16	5	5	7	7	5	6	34	34
Lower Arkansas, White, Red	15	15	9	9	38	38	9	9	71	71
Total	233.5	223.5	56	55	340.5	334.5	115	132	745	745
Western:										
Upper Missouri	106	106	169	169	31	30	17	18	323	323
Upper Arkansas, White, Red	36	34	53	53	11	11	9	11	109	109
Western Gulf	29	28	38	37	26	26	28	30	121	121
Upper Rio Grande-Pecos	3	3	59	59	19	19	7	7	88	88
Colorado	4	4	88	88	44	44	20	20	156	156
Great Basin	3	3.5	65	65	25	24	19	19.5	112	112
Pacific Northwest	17	17	49	48	83	83	9	10	158	158
Central Pacific	10.5	10	7	7	36	35	12.5	14	66	66
South Pacific	1.5	1.5	6	6	5	5	13.5	13.5	26	26
Total	210.0	207.0	534	532	280	277	135.0	143.0	1,159	1,159
United States	443.5	430.5	590	587	620.5	611.5	250	275	1,904	1,904

1/ Projections are rounded to the nearest million acres except for specific items in certain regions which are rounded to the nearest half million.

Table 37.- Projections of major uses of land at medium population levels, by water resource regions, 1980 and 2000 1/

Water resource region	Cropland		Grassland pasture		Forest		Other		Total area	
	1980	2000	1980	2000	1980	2000	1980	2000	1980	2000
	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres
Eastern:										
New England	3	3	1	1	29	27	4	6	37	37
Delaware and Hudson	4	3	1	1	9	6	8	11	22	22
Chesapeake Bay	10	12	3	2	21	19	7	9	41	41
Southeast	40	54	9	9	96	85	24	21	169	169
Eastern Great Lakes	12	12	2	1	9	7	7	10	30	30
Western Great Lakes	16	16	3	3	29	26	9	12	57	57
Ohio	40	42	9	8	30	27	12	14	91	91
Cumberland	3.5	4	1	1	5.5	5	1	1	11	11
Tennessee	7	9	2	2	14	14	4	2	27	27
Upper Mississippi	70	75	5	5	24	22	17	14	116	116
Lower Mississippi	18	18	6	6	13	12	2	3	39	39
Lower Missouri	18	18	5	5	7	6	4	5	34	34
Lower Arkansas, White, Red	19	25	9	8	35	34	8	4	71	71
Total	260.5	291	56	52	321.5	290	107	112	745	745
Western:										
Upper Missouri	110	111	169	169	30	30	14	13	323	323
Upper Arkansas, White, Red	37	38	53	53	11	11	8	7	109	109
Western Gulf	32	42	38	37	26	25	25	17	121	121
Upper Rio Grande-Pecos	3	3	59	58	19	19	7	8	88	88
Colorado	4	4	88	88	44	44	20	20	156	156
Great Basin	3.5	4	65	65	25	25	18.5	18	112	112
Pacific Northwest	18	18	48	48	83	82	9	10	158	158
Central Pacific	11	11	7	6	36	34	12	15	66	66
South Pacific	1.5	1	6	5	5	4	13.5	16	26	26
Total	220.0	232	533	529	279	274	127	124	1,159	1,159
United States	480.5	523	589	581	600.5	564	234	236	1,904	1,904

1/ Projections are rounded to the nearest million acres except for specific items in certain regions which are rounded to the nearest half million.

Table 38.- Projections of major uses of land at high population levels, by water resource regions, 1980 and 2000 1/

Water resource regions	Cropland		Grassland pasture		Forest		Other		Total area	
	1980	2000	1980	2000	1980	2000	1980	2000	1980	2000
	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres	Mil. acres
Eastern:										
New England	4	4	1	1	27	24	5	8	37	37
Delaware and Hudson	4	1.5	0	0	7	2	11	17.5	22	22
Chesapeake Bay	12	11	3	2	18	16	8	12	41	41
Southeast	58	66	9	8	85	68	17	27	169	169
Eastern Great Lakes	12	11	1	1	8	6	9	13	30	30
Western Great Lakes	17	15	3	3	27	23	10	16	57	57
Ohio	44	41	9	8	26	21	12	21	91	91
Cumberland	4	4	1	1	5	5	1	1	11	11
Tennessee	9	9	2	2	14	12	2	4	27	27
Upper Mississippi	75	73	5	5	23	19	13	19	116	116
Lower Mississippi	18	18	6	6	12	7	3	8	39	39
Lower Missouri	20	20	5	5	6	6	3	3	34	34
Lower Arkansas, White, Red	27	28	7	8	34	29	3	6	71	71
Total	304	301.5	52	50	292	238	97	155.5	745	745
Western:										
Upper Missouri	112	110	169	168	30	30	12	15	323	323
Upper Arkansas, White, Red	39	39	53	52	11	10	6	8	109	109
Western Gulf	43	42	37	36	26	25	15	18	121	121
Upper Rio Grande-Pecos	3	3	59	58	19	19	7	8	88	88
Colorado	4	3.5	88	87	44	44	20	21.5	156	156
Great Basin	3.5	3.5	65	65	25	24	18.5	19.5	112	112
Pacific Northwest	18	18	48	47	83	81	9	12	158	158
Central Pacific	12	11	7	6	35	32	12	17	66	66
South Pacific	1.5	1	6	5	5	4	13.5	16	26	26
Total	236.0	231.0	532	524	278	269	113.0	135	1,159	1,159
United States	540.0	532.5	584	574	570	507	210	290.5	1,904	1,904

1/ Projections are rounded to the nearest million or half million acres.

Table 39.- Annual irrigation water requirements per acre, by water resource regions, 1954

Water resource region	Required on farm			Required for storage or diversion		Estimated recovery of losses	Total irrigation requirement	
	Net required by plant	Efficiency of application	Total required	Storage and delivery efficiency	Total required			
	Acre-inches	Percent	Acre-inches	Percent	Acre-inches	Percent	Acre-inches	Acre-feet
Eastern:								
New England	6	60	10	60	17	20	15	1.2
Delaware and Hudson	8	60	13	60	22	20	19	1.6
Chesapeake Bay	10	60	17	60	28	20	24	2.0
Southeast	13	60	22	60	37	20	34	2.8
Eastern Great Lakes	8	60	13	60	22	20	19	1.6
Western Great Lakes	10	60	17	60	28	20	24	2.0
Ohio	10	60	17	60	28	20	24	2.0
Cumberland	8	60	13	60	22	20	19	1.6
Tennessee	9	60	15	60	25	20	22	1.8
Upper Mississippi	12	60	20	60	33	20	29	2.4
Lower Mississippi	13	60	22	65	34	20	30	2.5
Lower Missouri	12	60	20	65	31	20	27	2.2
Lower Arkansas, White, Red	12	60	20	65	31	20	27	2.2
Western:								
Upper Missouri	13	45	29	40	73	55	40	3.3
Upper Arkansas, White, Red	16	50	32	55	58	55	35	2.9
Western Gulf	13	50	26	60	43	55	27	2.3
Upper Rio Grande-Pecos	23	40	57	55	104	55	60	5.0
Colorado	31	45	69	55	126	55	74	6.2
Great Basin	21	45	47	55	85	55	50	4.2
Pacific Northwest	17	40	42	60	70	60	38	3.2
Central Pacific	26	50	52	50	104	55	61	5.1
South Pacific	28	50	56	50	112	55	66	5.5

Table 40.- Annual irrigation water requirements per acre, by water resource regions, 1980

Water resource region	Required on farm			Required for storage or diversion		Estimated recovery of losses	Total irrigation requirement	
	Net required by plant	Efficiency of application	Total required	Storage and delivery efficiency	Total required			
	Acre-inches	Percent	Acre-inches	Percent	Acre-inches	Percent	Acre-inches	Acre-feet
Eastern:								
New England	6	65	9	65	14	20	12	1.0
Delaware and Hudson	8	65	12	65	18	20	18	1.5
Chesapeake Bay	10	65	15	65	23	20	20	1.7
Southeast	13	65	20	65	31	20	27	2.2
Eastern Great Lakes	8	65	12	65	18	20	16	1.3
Western Great Lakes	10	65	15	65	23	20	20	1.7
Ohio	10	65	15	65	23	20	20	1.7
Cumberland	8	65	12	65	18	20	16	1.3
Tennessee	9	65	14	65	22	20	20	1.7
Upper Mississippi	12	65	18	65	28	20	25	2.1
Lower Mississippi	13	65	20	70	28	20	26	2.2
Lower Missouri	12	65	18	70	26	20	23	1.9
Lower Arkansas, White, Red	12	65	18	70	26	20	23	1.9
Western:								
Upper Missouri	13	55	24	45	53	55	31	2.6
Upper Arkansas, White, Red	16	60	27	60	45	55	29	2.4
Western Gulf	13	60	22	65	34	55	22	1.8
Upper Rio Grande-Pecos	23	50	46	60	77	55	47	3.9
Colorado	31	55	56	60	93	55	59	4.9
Great Basin	21	55	38	60	63	55	40	3.3
Pacific Northwest	17	50	34	65	52	60	31	2.6
Central Pacific	26	55	47	55	85	55	53	4.4
South Pacific	28	60	47	55	85	55	54	4.5

Table 41.- Annual irrigation water requirements per acre, by water resource regions, 2000

Water resource region	Required on farm			Required for storage or diversion		Estimated recovery of losses	Total irrigation requirement	
	Net required by plant	Efficiency of application	Total required	Storage and delivery efficiency	Total required			
	Acre-inches	Percent	Acre-inches	Percent	Acre-inches	Percent	Acre-inches	Acre-feet
Eastern:								
New England	6	70	8	70	13	20	12	1.0
Delaware and Hudson	8	70	11	70	16	20	14	1.2
Chesapeake Bay	10	70	14	70	20	20	18	1.5
Southeast	13	70	18	70	27	20	24	2.0
Eastern Great Lakes	8	70	11	70	16	20	14	1.2
Western Great Lakes	10	70	14	70	20	20	18	1.5
Ohio	10	70	14	70	20	20	18	1.5
Cumberland	8	70	11	70	16	20	14	1.2
Tennessee	9	70	13	70	19	20	17	1.4
Upper Mississippi	12	70	17	70	24	20	22	1.8
Lower Mississippi	13	70	18	75	25	20	23	1.9
Lower Missouri	12	70	17	75	23	20	21	1.8
Lower Arkansas, White, Red	12	70	17	75	23	20	21	1.8
Western:								
Upper Missouri	13	60	22	50	44	55	27	2.3
Upper Arkansas, White, Red	16	65	25	65	38	55	26	2.2
Western Gulf	13	70	19	70	27	55	19	1.6
Upper Rio Grande-Pecos	23	60	38	65	58	55	39	3.3
Colorado	31	60	52	65	80	55	53	4.4
Great Basin	21	60	35	65	53	55	35	2.9
Pacific Northwest	17	55	31	70	44	60	28	2.3
Central Pacific	26	60	43	60	72	55	47	3.9
South Pacific	28	65	43	60	72	55	48	4.0

Table 42.- Acreage of irrigated land in 1954, and acreage needed to meet specified production requirements for 1980 and 2000, by water resource regions

Water resource region	1954	Needed to meet production requirements					
		1980			2000		
		Low	Medium	High	Low	Medium	High
	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Eastern:							
New England	37,909	60,670	80,022	205,246	64,565	247,502	429,202
Delaware and Hudson	115,774	161,718	194,721	370,588	112,342	364,386	668,200
Chesapeake Bay	35,251	54,728	77,881	578,751	57,284	837,309	1,900,430
Southeast	524,826	849,899	1,079,297	3,357,581	896,290	4,355,735	8,484,433
Eastern Great Lakes	23,127	35,083	41,561	306,928	29,918	445,359	1,032,222
Western Great Lakes	28,317	44,150	70,881	471,377	48,192	664,877	1,462,493
Ohio	35,334	55,857	92,772	752,071	63,898	1,088,789	2,455,560
Cumberland	4,059	6,629	6,665	46,862	6,618	70,777	166,341
Tennessee	20,485	33,592	33,501	135,608	33,412	196,562	441,181
Upper Mississippi	34,735	56,820	101,134	1,661,861	70,026	2,533,653	6,027,547
Lower Mississippi	536,795	883,345	918,061	1,487,842	892,740	1,763,444	2,889,342
Lower Missouri	8,009	13,249	20,638	482,872	15,780	749,803	1,817,400
Lower Arkansas, White, Red	597,472	989,600	989,720	1,464,250	989,640	1,748,800	2,887,000
Total	2,002,093	3,245,340	3,706,854	11,321,837	3,280,705	15,066,996	30,661,351
Western:							
Upper Missouri	4,621,702	5,499,562	6,286,839	9,117,827	5,756,873	9,709,117	12,064,833
Upper Arkansas, White, Red	1,409,402	1,625,802	1,681,323	2,081,432	1,641,790	2,237,397	2,871,390
Western Gulf	4,431,503	5,021,832	5,125,631	6,350,527	4,980,656	6,821,266	9,011,679
Upper Rio Grande-Pecos	1,132,222	1,400,223	1,415,777	1,559,272	1,397,812	1,610,690	1,845,886
Colorado	2,813,311	3,283,483	3,279,881	3,326,635	3,268,401	3,340,071	3,433,326
Great Basin	1,935,702	2,242,338	2,257,338	2,314,962	2,241,208	2,319,527	2,370,619
Pacific Northwest	4,353,180	5,022,219	5,261,580	6,341,809	5,056,902	6,579,107	7,722,469
Central Pacific	6,063,656	6,874,728	6,868,908	7,265,928	6,492,505	6,984,976	7,509,997
South Pacific	789,384	827,022	815,725	921,097	706,606	842,706	999,508
Total	27,550,062	31,797,209	32,993,002	39,279,489	31,542,753	40,444,857	47,829,707
United States	29,552,155	35,042,549	36,699,856	50,601,326	34,823,458	55,511,853	78,491,058

Table 43.- Total water requirements, 1954

Water resource region	Irrigated acreage	Water required for-	
		Storage and diversion	Irrigation
	Thousand acres	Thousand acre-feet	Thousand acre-feet
Eastern:			
New England	38	54	46
Delaware and Hudson	116	213	186
Chesapeake Bay	35	82	70
Southeast	525	1,619	1,470
Eastern Great Lakes	23	42	37
Western Great Lakes	28	65	56
Ohio	36	84	72
Cumberland	4	7	6
Tennessee	20	42	36
Upper Mississippi	35	96	84
Lower Mississippi	537	1,521	1,342
Lower Missouri	8	21	18
Lower Arkansas, White, Red	597	1,542	1,313
Total	2,002	5,388	4,736
Western:			
Upper Missouri	4,622	28,117	15,253
Upper Arkansas, White, Red	1,409	6,810	4,086
Western Gulf	4,432	15,881	10,194
Upper Rio Grande-Pecos	1,132	9,810	5,660
Colorado	2,813	29,536	17,441
Great Basin	1,936	13,713	8,131
Pacific Northwest	4,353	25,392	13,930
Central Pacific	6,064	52,554	30,926
South Pacific	789	7,363	4,340
Total	27,550	189,176	109,961
United States	29,552	194,564	114,697

Table 44.- Total water requirements for projected low population levels, by water resource regions, 1980 and 2000

Water resource region	1980			2000		
	Irrigated acreage	Water required for-		Irrigated acreage	Water required for-	
		Storage and diversion	Irrigation		Storage and diversion	Irrigation
	Thousand acres	Thousand acre-feet	Thousand acre-feet	Thousand acres	Thousand acre-feet	Thousand acre-feet
Eastern:						
New England	61	71	61	65	70	65
Delaware and Hudson	162	243	243	113	151	136
Chesapeake Bay	55	105	94	57	95	86
Southeast	850	2,196	1,870	896	2,016	1,792
Eastern Great Lakes	35	52	46	30	40	36
Western Great Lakes	44	84	75	48	80	72
Ohio	56	107	95	64	107	96
Cumberland	7	10	9	7	9	8
Tennessee	33	60	56	33	52	46
Upper Mississippi	57	133	120	70	140	126
Lower Mississippi	883	2,060	1,943	892	1,858	1,695
Lower Missouri	13	28	25	16	31	29
Lower Arkansas, White, Red	990	2,145	1,881	990	1,898	1,782
Total	3,246	7,294	6,518	3,281	6,547	5,969
Western:						
Upper Missouri	5,500	24,294	14,300	5,757	21,111	13,241
Upper Arkansas, White, Red	1,626	6,098	3,902	1,642	5,200	3,612
Western Gulf	5,022	14,227	9,040	4,981	11,207	7,970
Upper Rio Grande-Pecos	1,400	8,984	5,460	1,398	6,756	4,613
Colorado	3,283	25,443	16,087	3,268	21,788	14,379
Great Basin	2,242	11,770	7,399	2,241	9,898	6,499
Pacific Northwest	5,022	21,760	13,057	5,057	18,544	11,631
Central Pacific	6,875	48,696	30,250	6,492	38,413	25,319
South Pacific	827	5,858	3,722	707	4,242	2,828
Total	31,797	167,130	103,217	31,543	137,159	90,092
United States	35,043	174,424	109,735	34,824	143,706	96,061

Table 45.- Total water requirements for projected medium population levels, by water resource regions, 1980 and 2000

Water resource region	1980			2000		
	Irrigated acreage	Water required for-		Irrigated acreage	Water required for-	
		Storage and diversion	Irrigation		Storage and diversion	Irrigation
	Thousand acres	Thousand acre-feet	Thousand acre-feet	Thousand acres	Thousand acre-feet	Thousand acre-feet
Eastern:						
New England	80	93	80	248	268	248
Delaware and Hudson	195	292	292	364	485	437
Chesapeake Bay	78	150	133	837	1,395	1,256
Southeast	1,079	2,787	2,374	4,356	9,801	8,712
Eastern Great Lakes	41	62	53	445	593	534
Western Great Lakes	71	136	121	665	1,108	998
Ohio	93	178	158	1,089	1,815	1,634
Cumberland	7	10	9	71	95	85
Tennessee	33	60	56	197	312	276
Upper Mississippi	101	236	212	2,534	5,068	4,561
Lower Mississippi	918	2,142	2,020	1,763	3,672	3,350
Lower Missouri	21	46	40	750	1,213	1,350
Lower Arkansas, White, Red	990	2,145	1,881	1,749	3,353	3,148
Total	3,707	8,337	7,429	15,068	29,178	26,589
Western:						
Upper Missouri	6,287	27,770	16,346	9,709	35,603	22,331
Upper Arkansas, White, Red	1,681	6,304	4,034	2,237	7,084	4,921
Western Gulf	5,126	14,522	9,227	6,821	15,347	10,914
Upper Rio Grande-Pecos	1,416	9,086	5,522	1,611	7,786	5,316
Colorado	3,280	25,420	16,072	3,340	22,268	14,696
Great Basin	2,257	11,849	7,448	2,320	10,247	6,728
Pacific Northwest	5,261	22,796	13,679	6,579	24,125	15,132
Central Pacific	6,869	48,653	30,224	6,985	41,910	27,242
South Pacific	816	5,780	3,672	843	5,058	3,372
Total	32,993	172,180	106,224	40,445	169,428	110,652
United States	36,700	180,517	113,653	55,513	198,606	137,241

Table 46.- Total water requirements for projected high population levels, by water resource regions, 1980 and 2000

Water resource region	1980			2000		
	Irrigated acreage	Water required for-		Irrigated acreage	Water required for-	
		Storage and diversion	Irrigation		Storage and diversion	Irrigation
	Thousand acres	Thousand acre-feet	Thousand acre-feet	Thousand acres	Thousand acre-feet	Thousand acre-feet
Eastern:						
New England	205	239	205	429	465	429
Delaware and Hudson	371	556	556	668	890	802
Chesapeake Bay	579	1,110	984	1,900	3,167	2,850
Southeast	3,357	8,671	7,385	8,484	19,089	16,968
Eastern Great Lakes	307	460	399	1,032	1,376	1,238
Western Great Lakes	471	903	801	1,462	2,437	2,193
Ohio	752	1,442	1,278	2,456	4,094	3,684
Cumberland	47	70	61	167	223	200
Tennessee	136	249	231	441	698	617
Upper Mississippi	1,662	3,877	3,490	6,028	12,056	10,850
Lower Mississippi	1,488	3,472	3,274	2,890	6,020	5,491
Lower Missouri	483	1,047	918	1,817	3,483	3,271
Lower Arkansas, White, Red	1,464	3,172	2,782	2,887	5,534	5,197
Total	11,322	25,268	22,364	30,661	59,532	53,790
Western:						
Upper Missouri	9,118	40,274	23,707	12,065	44,242	27,750
Upper Arkansas, White, Red	2,081	7,804	4,994	2,871	9,092	6,316
Western Gulf	6,350	17,990	11,430	9,012	20,277	14,419
Upper Rio Grande-Pecos	1,559	10,004	6,080	1,846	8,922	6,092
Colorado	3,327	25,784	16,302	3,433	22,888	15,105
Great Basin	2,315	12,154	7,640	2,371	10,473	6,876
Pacific Northwest	6,342	27,480	16,489	7,722	28,316	17,761
Central Pacific	7,266	51,465	31,970	7,510	45,060	29,289
South Pacific	921	6,523	4,144	1,000	6,000	4,000
Total	39,279	199,478	122,756	47,830	195,270	127,608
United States	50,601	224,746	145,120	78,491	254,802	181,398